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LONGEVITY AND THE LIFESTYLE OF THE OLDER INDIVIDUAL

HEARING

BEFORE THE

SUBCOMMITTEE ON AGING

OF THE

COMMITTEE ON LABOR AND HUMAN RESOURCES UNITED STATES SENATE

NINETY-EIGHTH CONGRESS

SECOND SESSION

ON

EXAMINING THE OVERALL PROSPECTS FOR LONGEVITY IN OUR NATION AND OTHERS, HOW LONGEVITY CAN BE ACHIEVED, AND WHAT ACTIONS THE GOVERNMENT SHOULD TAKE TO ENSURE THAT OUR OLDER POPULATION WILL HAVE A MORE POSITIVE, PRODUCTIVE AND VIGOROUS LIFE

SEPTEMBER 27, 1984

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LONGEVITY AND THE LIFESTYLE OF THE OLDER INDIVIDUAL

THURSDAY, SEPTEMBER 27, 1984

U.S. SENATE,
SUBCOMMITTEE ON AGING,
COMMITTEE ON LABOR AND HUMAN RESOURCES,
Washington, DC.

The subcommittee met, pursuant to notice, at 10:05 a.m., in room SD-430, Dirksen Senator Office Building, Senator Claiborne Pell, presiding pro tempore.

Present: Senators Pell, Thurmond, and Chafee (ex officio).

OPENING STATEMENT OF SENATOR PELL

Senator PELL. The Subcommittee on Aging will come to order, and I would open by expressing my very warm and very real gratitude to the chairman of this subcommittee, Senator Grassley, for permitting this hearing to take place, and to Mr. Pete Conroy of his staff, who has facilitated and made possible this hearing. So I thank Senator Grassley and Mr. Conroy very much indeed.

Senator Grassley has some commitments this morning. He cannot be here and has been kind enough to say that I could preside over this subcommittee hearing. We do have a statement from him and we will insert it in the record at this point.

[The prepared statement of Senator Grassley follows:]

PREPARED STATEMENT OF SENATOR GRASSLEY

The subject of this mornings hearing holds great interest for members of the Subcomittee, for we deal legislatively with the needs of American's older cohort through the programs of the Older Americans Act.

Why some people are blessed with longer lives than other has been a question pondered through the ages, but science and demographers are beginning to provide us with some partial answers. Several of this morning's witnesses are among those groups and should provide results of their research.

Two of the witnesses will provide us living proof of longevity and what contributes to it. Their presence here is a testimony to the vitality and energy of this nations very old. Hopefully, we may learn their secret and they will share with us this morning those family habits, diet and beliefs that contributed to their long and full lives.

I thank my colleague, Senator Pell, who has long pushed for more inquiry in this field and sees this area of gerontology as one that needs more study—in fact, this may be only the first of several hearings on this subject held by this Committee.

Senator PELL. I guess what this hearing came out of was a trip I took to the Soviet Union about a year ago and I was very impressed with the ages and vitality of some of the people there.

I can remember talking with a group of 10 or 15 people, each of whom was over 100, some over 110, and seeing these people vital

and active and full of life made me wonder whether there was some secret there or whether there were some factors and common denominators that we could bring into our own life in this country.

These phenomena, if they are phenomena, or occurrences occur not only, as we know from medical records, in the Soviet Union, but occur in parts of the Himalayas and in other parts of the world.

Then I thought it would be interesting to try and see some of our own citizens who have also achieved great longevity combined with intellectual vigor and physical ability to move, and see if we could learn from them, and that is the reason for going into this hearing.

Today, we will be receiving testimony from several witnesses who will bring their own expert knowledge to bear on the subject at hand.

Throughout my own career in the Senate, I have had a particular interest in the needs of our aging population. Perhaps as I have become more aged, I have become more interested in their needs.

It has become increasingly clear, too, with the developments in medical technology that our population is growing older and capable of a more productive life in their later years, and this hearing, which I hope may be the predecessor of others, is to hear the views of some individuals who have achieved remarkable lifespans and to hear their views and the views of experts in this area concerning the factors that may influence longevity and the public policy decisions that should be made to respond to an aging society.

The goals of this hearing and others that may be convened are to determine the overall prospects for longevity in our Nation and others, how longevity can be achieved, and what responses the Government should be having to ensure that our older population will have a more positive, productive, and vigorous life.

I am aware that the time to address these issues is upon us because our population and that of other nations is growing older, and to be a responsible government, we must be addressing the fact that in a few short years we will have before us an older population and the needs may be very different than the needs of our population today.

Originally when we set this hearing up and Senator Grassley was kind enough to give us permission, my hope had been that we would have been able to secure the presence in the United States of Professor Dalarischvili, who is the doctor in Georgia that I interviewed when I was there. But arrangements could not be made to bring him over here, and then we asked the Soviet Union if they would provide a witness or their medical attaché who could give us some of their views.

They said it was their custom not to permit their personnel to appear before congressional committees, so we have done the best that we can working within our own borders. I would ask at this point unanimous consent to insert in the record the highlights of the conversation of our group last summer with Professor Dalarischvili which took place in Tbilisi, Soviet Union, on August 28, 1983.

[The following was received for the record:]

SUBJECT: Highlights of our conversation with Professor Dalarischvili which took place between 1100 and 1200 hours on 28 August 1983 at Iveria Hotel in Tbilisi USSR

Professor Dalarischvili is Chief, Department of Gerantology, Institute of Experimental Morphology of the Academy of the Sciences of GSSR in Tbilisi. He is in contact with Institute of Aging of NIH in Baltimore, Maryland as well as other scientific institutions in the U.S.

Following statement were made by Professor Dalarischvili usually in response to questions by US Senators:

a. He does not believe that there are people who are more than 120 years old alive today. His contact with individuals in the Georgian Socialist Republic and careful evaluation of the documents supporting their age made him make this statement. The verification is done by checking their baptism certificate, if the individual is of orthodox faith, or other indirect ways which have to be carefully checked. One individual who recently died claimed to be 122 years old and by evaluation of his tooth using radioactive carbon (this test was done in the US) it was proven that the individual was between 120 and 122 years old.

b. On the average there are as many women who claim the age of 100 but after that, most of the individuals who live longer are of male gender.

c. There is not a single factor which makes the people live longer. It is a combination of many, and environmental factors and other conditions are all important. There is definitely a genetical disposition, but other factors play an important role.

d. All of the people attained high age were engaged in physical work during their life time. It was not necessarily hard work, but living in the mountains, they were engaged mainly in agricultural work as well as raising sheep and working with cattle. These people frequently move higher in the mountains with their sheep or cattle during summer months, or are engaged in some kind of activities at high altitudes. This frequent move from lower to higher altitudes in the mountains, has made them produce more red blood cells frequently and adapt to the living in high altitudes. This is an interesting factor which has to be investigated.

e. There was no specific diet those people did follow. They ate a lot of fruit and vegetables. They ate meat only once a week and used eggs maybe 2 or 3 times a week by eating one or two eggs. Their intake of animal protein appears to be on the lower side. They all used alcohol in moderate amounts, drinking wine or brandy made out of the remnants of grapes. Some did smoke, but only pipe. On the average they slept 10 to 11 hours a day but took afternoon naps and have slept at night between 6 and 7 hours

SUBJECT: Highlights of our conversation with Professor Dalarischvili which took place between 1100 and 1200 hours on 28 August 1983 at Iveria Hotel in Tbilisi USSR (Con't)

in a stretch. The same has pattern exists up to present. All those alive at present are living within large families, with three or four generations living together. All these old people are deeply respected within the family, where they have a position which carries a lot of respect. They are all engaged in some kind of work, like feeding chickens, feeding other animals, and doing minor chores. Although the family could go without their help, they are encouraged and they are engaged in giving those small contributions to the family life and thus feel important to the family. They are kept abreast of all developments in the family, they are asked for advice and expected to be acting arbitrators in family affairs. All the older people are usually in a state of good health although they suffer from common ailments as everybody else. The major cause of death among them is from arteriosclerotic heart disease and calcification of the arteries. Among other causes of death, the cause of cancer is very rare and is in the 6th place. Cancer is rare in those communities anyway. Towards the end of their lives they also suffer from loss of hearing, occassional cataracts and become slowly senile with forgetfulness of the recent events. The questions of their religious belief was answered, that some of them do, and some of them don't believe, but basically they follow a pattern of life based on certain moral standards and they do not deviate from those standards. They try to lead a life without any significant stress, conform to the rules of the community and try not to have any extra stress interfere with their lives.

f. Not much was said about their sexual activities. It was stated that it was very difficult to check on those things, partially because the answer might not be true. It has been documented though, that some of the males in their 90's have married women of child bearing age and have fathered children while they were in advanced age.

g. Professor Dalarischvili is not engaged in strictly medical problems of those individuals. Therefore, he was not able to give complete answers on certain questions. He stated though that during the life of all individuals there are several critical steps which influence the further development and well being of an individual. Some of these critical times are age of 5, then 40-60 and 75. Usually the breakdown of different immunological barriers begins after age of 40. If the individual survives the period of 40-60 without any significant diseases or health problems, he will probably reach the next stage without any great difficulties. By age of 75, the immune mechanisms continue to deteriorate and the processes continue. If that age has been passed again without any significant problems, statistically the individuals have a chance to reach advanced age. It is known that approximately 20% of all people have some minor genetical abnormalities and they would show themselves at those steps. Again if no significant insult occurs it can be assumed that this individual would have a longer life.

SUBJECT: Highlights of our conversation with Professor Tolarischvili which took place between 1100 and 1200 hours on 22 August 1983 at Iveria Hotel in Tbilisi USSR

h. All the Centenerians and people of advanced age are now being registered and it is tried to find out about their life style as much as possible. This project is an ongoing project and some areas are covered some are not. Since there are older individuals in other countries too, the data of their evaluation is compared to the one's obtained here. Again it's stated that good connection exists with American Institutions and the data is shared with them. Unfortunately the media has looked into this subject too and some of their statements like "eating yogurt is good for you" as well as other things, really do not reflect the true picture. There is no magic formula by which one can reach advanced state. Therefore gathering of all available data and sharing information is important before any conclusions can be made.

Senator PELL. Now, we come to our witnesses who are with us today. Dr. Soldo has, I know, a teaching commitment, so she has to leave quite promptly. So we will go in sort of reverse seniority order and put the youngest witness on first.

Dr. Soldo?

STATEMENT OF BETH SOLDO, CENTER FOR POPULATION RESEARCH, GEORGETOWN UNIVERSITY, WASHINGTON, DC; RUTH M. CLARK, WARWICK, RI; AND ROSINA BUDD HARVEY CORROTHERS TUCKER, WASHINGTON, DC

Dr. SOLDO. Thank you very much, Senator Pell. I obviously am a candidate for longevity. I have no firsthand experience in the area. I am a professor in gerontology and demography at Georgetown University, and a senior research scholar at the Kennedy Institute of Ethics. My background and my position allow me to talk both about the empirical side of our policy for our elderly as well as the ethical or the value-based side of those considerations.

Certainly, you and your staff are to be congratulated for convening these hearings, a careful investigation of what might be called the longevity. All too often, this issue is couched in terms of wishful thinking or hysterical rhetoric, and if we are to deal effectively as a country with our aging population, surely it must be in the context of a scientifically creditable vision of the future.

The prospects for extending the life of our citizens have very obvious and significant implications for the Federal budget if only we think in terms of the aggregate demand on Social Security and the medicare trust fund.

But extending life also has equally significant import for the quality of life of those among us who are spared premature mortality. Thus, I particularly applaud your efforts to balance the quantity of life issue with the quality of life concern in convening these hearings.

I suspect that every technical witness that you hear from begins with the caveat that theirs is a very complex area involving a network of relationships. I, too, begin with this caveat and set, therefore, very simple objectives for my few minutes with you this morning.

They are, first, to simply convey an overview of the progress we have made in this country in mortality reductions and our pros-

pects for further improvements; second, to understand the impact of life extension on quality of life, defined very simply in terms of morbidity and disability.

In these prepared remarks, I will be referring to a set of tables which I believe you have before you. Many of the pieces in that hand-out are from an excellent document prepared by your colleagues on the Senate Special Committee on Aging, entitled "Aging America: Trends and Prospects."

Like most other developed countries, the United States, since 1900, has made substantial progress in reducing mortality, and a useful way to measure this is in terms of life expectancy; that is, the average number of years of life remaining at any given age if we are willing to assume that the then current schedule of mortality will remain over time.

These data are shown in both life expectancy at birth and at age 65, and by sex in that first table. In the United States, life expectancy at birth has risen from 49 years in 1900 to nearly 70 years in 1954, and now almost 74 years.

Perhaps more significant is the fact that three-fourths of every group of children born in this country can expect to attain that age of 74. In the first half of this century, life expectancy increased by almost 20 years, but it then plateaued in about 1954 and little change or improvement was seen over the next 14 years.

Since 1968, again we see tremendous advances in pushing back and extending life. Obviously, our life expectancy at birth reflects death rates at all ages, including the high-risk periods of infancy and young adulthood. Thus, it does not indicate exactly where these improvements have occurred, and because of this it is also useful to talk about life expectancy at age 65.

In the first half of this century, we did not make much progress in extending life expectancy at 65. This was because most of the significant reductions we had in mortality early on were due to control of the infectious and acute diseases, particularly with the introduction of antibiotics.

Improvements in extending old age life expectancy are relatively recent phenomena. Today, a male at age 65 can expect to survive an additional 13 years to age 78, and females an additional 18 years, on average, to age 83.

Another way to understand this achievement that we have had over the last about 20 years is to realize that in 1930, only about half of our citizens reached age 65. Today, three-quarters, at least, reach age 65. In just this short period of time, we have had a survival gain that can be estimated as 23 persons aged 65 for every 100 children born in this country. This trend of increasing older citizens has obvious implications for Social Security.

There are two other facts I just want to briefly mention before I turn to a discussion of what caused these changes, how the United States stands in a cross-national comparison, and where we might go from here.

The first of these facts you need to be aware of is that male life expectancy at any age is lower than female life expectancy. The second fact that you should be aware of concerns the 85-plus age group. This is the fastest growing segment in our population today.

Although we have seen improvements in life expectancy at both ages 65 and 85, the increases at age 85 are most striking, and particularly for females. In the last 20 years, for example, life expectancy for 65-plus individuals has increased by 15 percent, but by 24 percent for the very old among us.

Indeed, life expectancy at age 85 is projected to increase by another 44 percent by the year 2040. During this same time, the absolute number of women 85 and over is likely to increase by 51 percent. Putting these together, it implies an increase of 117 percent in the number of person-years to be lived by our very old women.

One way to appreciate the progress that the United States has made in recent times in extending both life expectancy at birth and at age 65 is to locate our progress in a cross-national comparison, and this is done for select developed countries in table 2 of your handout.

These 11 countries have the highest life expectancies at both birth and at age 65 in the world. Of these 11 countries, however, the United States ranks eighth in male life expectancy at birth, seventh in female life expectancy at birth, sixth in male life expectancy at 65, but second in female life expectancy at age 65.

Thus, these data suggest that there is potential for improvement in the United States. But it also is important to note that the United States lags, at most, by about 3½ years behind the countries with the highest life expectancies at either ages.

It is also important to note that of the 11 countries shown, only 3—Canada, the United States, and Japan—have made significant progress since the midpoint in this century. Japan is particularly impressive since, in 1950, its mortality structure very closely resembled that of a developing country, and in a mere 30 years has achieved one of the most significant reductions in mortality.

In some cases, in fact, Japanese life expectancy has caught up and even surpassed the life expectancies of the Scandinavian countries.

In order to understand why we have seen these recent improvements, we need to take a look at the death rates that affect our elderly. Death today in the United States is an event of old age.

To give you an example, only 1 percent of our population is 85 and over, and yet 20 percent of all deaths occur in this age group. The mortality patterns of the elderly are obviously of special interest to us because as death rates at the younger ages quickly approach an irreducable level, old age mortality literally becomes the last frontier for further significant reductions in our mortality rates.

Since 1968, these mortality rates have dropped significantly; again, females more than males, and they have been most pronounced, surprisingly, at age 85. The leading causes of death are heart disease, cerebral vascular disease, and malignant neoplasm. These account for three out of every four of our deaths.

Now, changes in the death rates have implications for both society and for our individual citizens, and two of the most obvious I have already mentioned: gains in life expectancy and increases in the proportions surviving.

But mortality reductions also have the effect of increasing the survival time for individuals affected by life-threatening diseases.

Recently, one of my colleagues that I write with frequently did an analysis of cross-cultural comparisons of mortality and patterns, and estimated that the mean age at death for those with both heart disease and cancer—now, this is shown for the United States only in table 4 and for all of the developed countries we looked at in table 5.

For the United States, our data suggests that mortality reductions have been accomplished primarily by delaying the mortal impact of chronic disease; in other words, by extending the length of time an individual has the disease.

The average age at death has increased by a little more than 2.5 years over the last three decades for males dying from either heart disease or from cancer. The mean age at death for women with heart disease has increased by 5.5 years, and with cancer by nearly 4 years.

Senator PELL. Thank you very much. These self-explanatory tables will be put in the record as they are.

Dr. SOLDO. Thank you.

[Information supplied for the record follows:]

MORTALITY PATTERNS IN DEVELOPED COUNTRIES BY KENNETH G. MANTON, ASSOCIATE RESEARCH PROFESSOR, DEMOGRAPHIC STUDIES, DUKE UNIVERSITY

ABSTRACT

Life expectancy, both at birth and at later ages, has been increasing in recent years in developed countries. These increases pose serious challenges to the capacities of those countries to provide social and health services to their rapidly aging populations. In this paper we examine the cause specific mortality changes in 11 developed countries. The purpose of this analysis is threefold. First, we simply wish to describe the cause-specific mortality patterns associated with these changes and their cross-national variability. This will be done by examining several different types of life table analyses of the cause specific mortality patterns in those countries. Second, by assessing the variability of the cause specific mortality patterns we wish to determine the potential for further mortality reductions. Finally, we will search for patterns in our description of cause specific mortality changes which can serve as the basis for formulating elements of a theory of mortality changes in societies which have attained very high levels of life expectancy where the predominant health problems are chronic disease and disability.

INTRODUCTION

There has been considerable concern in the U.S. about the capacity of society to respond to the social, economic, and health service implications of a rapidly aging population. For example, there have been recent efforts to ensure the fiscal stability of the Social Security system. More recently attention has focused on the fiscal viability of the Medicare system and its capacity to meet the health needs of the U.S. elderly population after 1990. For both systems there have been program changes and proposals to raise the age of entitlement to reflect recent increases in life expectancy at advanced ages.

Concerns about the fiscal viability of Social Security and health insurance systems are by no means unique to the U.S. Many European countries are facing similar concerns about the carrying capacity of their social security and health service systems. In Japan, due to a birth rate declining more rapidly than anticipated, and a life expectancy among the highest in the world, the magnitude of the problem may even be greater than in the U.S. (Nihon University, 1982).

One of the central factors creating these concerns is the rate of increase in life expectancy at advanced ages. This increase in life expectancy accelerates the rate of growth of the elderly population and, perhaps more significantly, has increased the rate of growth of the very elderly population (aged 85 and over)--a population group with extremely high health care and social welfare needs. To evaluate the impact of recent mortality reductions on the social security and health service systems of developed countries we have analyzed the mortality conditions of 11 developed countries over the period 1950 to 1978. These countries

were selected because they a.) had achieved historically high life expectancy values, b.) have reasonably good quality mortality data, and c.) represent some regional distribution (U.S. and Canada for North America; Japan for Asia; Norway, Sweden, Denmark for Northern Europe; Czechoslovakia and Hungary for Eastern Europe; and Great Britain, West Germany, France for Western Europe).

Since the 11 countries were systematically selected they do not represent a "random sampling" of the recent mortality experience of all countries of the world nor, for that matter, even of the developed countries of the world. Instead the analyses that will be conducted should be viewed as 11 "coordinated" analyses (using common concepts and methods) of individual country cases. It is our intent that these coordinated analyses will involve a very detailed examination of the cause of death structure of these countries and its change 1950-1978. Although these 11 countries are not representative of the global or developed country mortality experience, they will help us to determine the range of variation of certain mortality characteristics and patterns. Examining the cross-national variation of mortality experience in countries with high life expectancies will help us to examine a number of empirical and theoretical issues.

Empirically the analysis will allow us to ascertain the relative similarity/dissimilarity of mortality patterns among developed countries all of whom have reached historically high life expectancy values. For example, were recent declines in mortality in these countries associated with the same changes in cause specific mortality patterns? More particularly, were there significant differences in recent declines/increases

in the mortality risks of major chronic diseases (for example, cancer, heart disease, stroke) and how did the mortality patterns of these chronic diseases differ for males and females? We will also wish to determine if there are distinct signs of cohort variation in these cause specific mortality changes.

Beyond simply describing variation in mortality patterns, the analyses may be helpful in developing models for forecasting future mortality changes in societies with high life expectancies. For example, if cause of death changes are similar among countries at high levels of life expectancy we might argue that their populations are undergoing the same health status transitions. If different countries are manifesting different patterns of change this may imply a greater ultimate potential for mortality reductions in any one country because other avenues remain for the continuation of the mortality declines. Furthermore we will wish to determine the direction of the correlation between the rate of mortality decline at advanced ages and the attained life expectancy level. If the rate of mortality decline at advanced ages is not negatively associated with current achieved life expectancy levels then there would seem to be greater potential for continuing mortality reductions (Lopez and Hanada, 1983).

In addition to generating descriptions of recent mortality declines and assessing the evidence for continuing mortality reductions, the analyses may help generate theoretical insights into mortality patterns in countries with high achieved life expectancy. For example, Omran (1971,1975a,b) developed a theory of the "epidemiological transition" as a model of the public health changes of a society in order to complement

the theory of the demographic transition and various models of the stages of economic development. The problem with Omran's theory is that it does not indicate what further health state changes we should expect in developed societies. After having achieved reductions in infant and maternal mortality and societal conditions where the major public health problems are related to chronic disease, Omran's model does not indicate how chronic disease morbidity and mortality patterns can be expected to change. Clearly with a number of developed countries achieving Omran's final societal state, and with mortality patterns continuing to change, there is a critical need for a new, expanded theoretical perspective to explain the continuing changes.

The most crucial aspect of a theory of mortality for countries achieving very high levels of life expectancy (for example, $\mathring{e}_0 > 70.0$) would be a description of the biomedical correlation of chronic disability and morbidity with mortality reductions. Several such models have been put forth to explain recent U.S. experience (see Fries, 1980; Kramer, 1981; Gruenberg, 1977; McKinlay and McKinlay, 1977; Strehler, 1975) but do not adequately explain currently observed mortality reductions (Social Security Administration, 1980) and certain observed correlations between life expectancy gains and changes in the age specific incidence and severity of particular chronic diseases (Manton, 1983). Furthermore, there is continuing debate even over the direction of the biomedical correlation of chronic morbidity and disability with mortality declines. Given the inadequate state of currently available theory, and the significance of the implications of such theory for our expectations about society's ability to cope with currently emerging mortality and

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health status patterns, the need for both additional empirical and theoretical work is clear.

In conducting the proposed theoretical and empirical evaluation of cause specific mortality patterns and changes we must be aware of certain conceptual and operational limitations of this evaluation. First, our agenda is large. This is appropriate because we intend our analysis to provide a broad descriptive overview of the range of mortality conditions manifest in developed countries. Furthermore, in our task of theoretical development we will wish to consider a wide range of issues and concepts.

Second, operationally, the study of mortality conditions at advanced ages will always be hampered by data quality problems (for example, age reporting, reliability of cause of death diagnoses, appropriateness of cause specific diagnoses for mortality at later ages). Additionally, demographic data only indirectly reflect the health status changes underlying observed mortality pattern trends. Thus, those mortality patterns must ultimately be related to epidemiological and other data (for example, health survey, health service utilization) in order to directly evaluate the biomedical correlation of mortality and population health status. Such assessments will require different types of data and analytic methods such as compartment modeling strategies to relate cancer mortality patterns to changes in cancer prevalence (Manton and Liu, 1983). In this paper we will simply attempt to illustrate the framework and data that could be used in such an analysis.

Finally, there is a critically important distinction that must be maintained in cross-national mortality analyses--especially analyses of countries that have achieved historically high levels of life expectancy.

This distinction is between the level of life expectancy that is achieved in a given society and the biological potential for life expectancy. In the U.S., for example, there have been recent life expectancy increases--even at very advanced ages (85+). However, given the heterogeneity of U.S. society it is hazardous to predict to what degree such patterns approximate "optimal" conditions. For example, current lifestyle conditions in the U.S. (such as continuing high levels of tobacco and alcohol consumption, occupational health hazards, and environmental hazards) dictate that it will be difficult for the U.S. population to even approach the biologically "optimum" life expectancy. In addition, there exist many inequities in the geographic and socioeconomic availability of medical services. This distinction leads to two conclusions about the mortality changes observed in our analyses. First, the evaluation of the potential for continued mortality reduction based on recent experience must be conducted in the context of country specific lifestyle, medical service inequity, and other societal factors limiting life expectancy increases. Second, the prediction of future life expectancy change must always recognize the practical constraints to further progress. That is, the recent experience of the U.S. shows that, though further major increases in life expectancy may be biologically and technically possible, the rising costs of medical care may force society to consciously forgo certain opportunities for advancement.

In the remainder of this paper we will a.) discuss data sources and data quality issues, b.) discuss certain life table models that will be employed in our analyses, and c.) present the results of a variety of cause specific analyses. A discussion of the implications of cause of death structure changes at later ages will follow.

DATA

The cause specific mortality data and the population data used in the current analyses were taken from a mortality data bank maintained by the Dissemination of Statistical Information unit of the World Health Organization (WHO). In that data bank, mortality and population data for nearly 80 countries of the world are maintained. As might be expected, the quality of both population and mortality data for individual countries is highly variable. Of particular concern for our analyses are the quality of cause of death diagnoses which appear to vary considerably, even for the 11 developed countries selected for our analysis, over the period of investigation 1950 to 1978.

One crude index of data quality is the proportion of deaths which are assigned to the senility and ill-defined condition category. In Table 1 we provide the percentage of all deaths over age 65 which were diagnosed as due to "senility and ill-defined conditions" in the 11 countries.

TABLE 1 ABOUT HERE

In Table 1 we see that there has been a general decline in the proportion of deaths assigned to senility and ill-defined conditions, for both males and females, over the period 1950 to 1978. In general the proportion of deaths assigned to senility and ill-defined conditions is higher for each country for females--and remains higher through to 1978. Four of the countries (U.S., Canada, Denmark, and Great Britain) have small percentages of deaths assigned to senility and ill-defined conditions for all dates--even 1950. The two Eastern European countries (Hungary and Czechoslovakia) have high percentages of deaths reported as due to senility and ill-defined conditions in 1950-1955, but have very

small percentage of deaths assigned to these causes by 1975-1978. Sweden shows a similar pattern of decline. Norway, West Germany, France, and Japan show very large proportions of elderly deaths assigned to senility and ill-defined conditions in 1950, and though dropping rapidly, they remain at fairly high levels in 1978 (for example, 8.43 and 8.83 percent for Japanese and French females).

The proportion of deaths assigned to senility and ill-defined conditions is only a very rough index of data quality--especially for deaths at later ages. This is due to at least two factors. First, the selection of a single "underlying" cause of death diagnosis to describe mortality at advanced ages may be difficult in the face of a high prevalence of associated or contributory causes of death at later ages (see Manton and Stallard, 1982a). Second, apart from problems in selecting an underlying cause of death, a single diagnostic category may not adequately describe the complexity of the physical state of the elderly decedent. Multiple cause mortality data, where all reported associated causes of death are indicated, will often provide a more realistic description of mortality at advanced ages (Manton and Stallard, 1982a). Consequently, it is clear that the underlying cause of death data generally available for international study will often only be a rough approximation to the medical characteristics of the elderly person at the time of death.

The figures in Table 1 suggest that the quality of cause of death reporting in the 11 selected developed countries, though being initially poor for seven of these countries, has improved markedly over the period 1950 to 1978. Perhaps the most suprising observation, however, is the very poor quality of cause specific mortality data suggested by the high rate of senility and ill-defined conditions reported in Japan (18.2 and

24.1 percent) and France (23.7 and 25.8 percent) in 1950. In order to deal with the large changes in this category of senility and ill-defined conditions over the study interval for some countries, deaths assigned to this category were proportionately allocated, on an age and sex specific basis, to specific chronic diseases. As can be seen from the table this adjustment will have relatively little effect in more recent years. In 1950, the effect of the adjustment will be considerable for some countries.

Five causes of death were selected for analysis from the WHO list A (cancer, diabetes mellitus, heart and hypertensive diseases, stroke, and cirrohsis). Even apart from general data quality issues, there may be variability in the assignment of deaths due to these causes because of country differences in diagnostic customs and due to changes in the International Classification of Diseases (ICD) (especially for heart disease). We do not have precise information on differences in diagnostic customs between the 11 countries. We can, however, examine changes in the ICD. The period 1950 to 1978 involved two changes in classifications (between the 6th and 7th and between the 7th and 8th revisions). The most problematic of these changes was from the 7th to 8th revision. The 6th, 7th, and 8th revision definitions of our diagnostic categories are presented in Table 2 along with the WHO A-list categories, and the comparability ratios calculated based on data provided by the National Center for Health Statistics (NCHS) comparing the 7th and 8th revisions (Klebba, 1975).

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As can be seen, the comparability ratios for these five conditions are all within $\pm$ one percent. Other disease categories do not have such

high comparability ratios (for example, nephritis and nephrosis: 0.8862). Thus, if the diagnostic comparability in the other 10 countries for these five conditions is similar to that in the U.S., we should be reasonably confident in our results--at least in the more recent years.

METHODS

Using the mortality and population data in the WHO data bank, we calculated age, sex, and cause specific mortality rates for each fifth year (except where noted) in the interval 1950 to 1978. These rates were used to calculate life tables of several types. Besides calculating standard abridged period life tables, life tables were calculated assuming that each of the chronic diseases selected for analysis was eliminated using the Chiang (1968) adjustment of the age specific probability of death, or,

$$q_{x \cdot A} = 1 - (1 - q_x)^{(D_{xB}/D_x)}$$

where q_x is the total probability of death at age x, $q_{x \cdot A}$ is the probability of death at age x with cause A hypothetically eliminated, D_x is the total number of deaths observed at age x, and D_{xB} is the number of deaths due to causes other than cause A.

New life tables parameters can be calculated simply by replacing q_x with $q_{x \cdot A}$. The differences between these and the standard life tables represent the hypothetical change in life expectancy that might be generated if cause of death A were wholly eliminated and other diseases operated independently to cause death.

A second type of life table that is calculated is the multiple decrement life table. This type of table represents the mortality experience for that portion of the population which is affected by a specific

cause of death. The probability of death due to cause A, denoted q_{xA}, may be simply calculated from q_x using the ratio of the observed number D_{xA} of deaths due to cause A to the total number D_x of deaths from all causes, or

$$q_{xA} = q_x \cdot D_{xA}/D_x.$$

With q_{xA} we can calculate the age specific number of deaths expected from cause A, or,

$$d_{xA} = \ell_x \cdot q_{xA}.$$

With the d_{xA} we can calculate the expected number ℓ_{xA} of deaths due to cause A after age x as

$$\ell_{xA} = \sum_{y=x}^{\omega} d_{yA}.$$

The ℓ_{xA} will be useful in examining the proportionate effect of cause A on a birth cohort subjected to the current mortality conditions of a given study population. Using several contiguous values of ℓ_{xA}, we can calculate the mean age at death due to cause A after age x in two steps. First, we need to calculate the total number T_{xA} of person-years expected to be lived after age x by persons who will die of cause A, or

$$T_{xA} = \int_x^{\infty} \ell_{yA} \cdot dy,$$

which is easily calculated using the trapezoidal rule (Chiang, 1968). Second, with T_{xA} calculated for each x, we can calculate the corresponding mean time to death from cause A simply as

$$\overset{o}{e}_{xA} = T_{xA}/\ell_{xA}.$$

Naturally, ℓ_{xA} varies from the relative frequency of deaths reported as due to a given condition, and the $\overset{o}{e}_{xA}$ varies from the observed mean age at death from that condition in a population, because those

latter statistics are affected by differential weighting in the current population due to different birth cohort sizes.

A third type of life table calculation that was conducted was the "saved" population calculation of the life expectancy gain expected from the hypothetical elimination of a specific disease. This life expectancy gain is adjusted to reflect the effects of the prevalence at death of the condition. Let $\overset{o}{e}_{x \cdot A}$ denote the life expectancy in the cause elimination life table which is computed by replacing q_x with $q_{x \cdot A}$. Hence, one can see that $\overset{o}{e}_{x \cdot A}$ replaces $\overset{o}{e}_x$ and the difference,

$$\Delta\overset{o}{e}_{x \cdot A} = \overset{o}{e}_{x \cdot A} - \overset{o}{e}_x,$$

is the difference between the life expectancy at age x after cause A is eliminated and the life expectancy at age x with cause A retained. The life expectancy gain $\Delta\overset{o}{e}_{x \cdot A}$ is assumed to be shared equally among the entire set of ℓ_x persons alive at age x, even though the value ℓ_{xA} in the multiple decrement table may indicate that only a small proportion of the population will die due to cause A. Since the entire benefit of elimination of cause A can be assigned to the subgroup ℓ_{xA}, an adjusted life expectancy gain which reflects the life expectancy increase for this "saved" population subgroup may be simply calculated as (Manton and others, 1980)

$$\Delta\overset{o}{e}_{xA \cdot A} = \Delta\overset{o}{e}_{x \cdot A} \cdot \ell_x / \ell_{xA}.$$

The significance of $\Delta\overset{o}{e}_{xA \cdot A}$ is that it reflects the average expected change in survival among individuals affected by disease A. Thus, it more closely represents the effect of eliminating a given disease on the life span of a person actually affected by the disease. In general,

$\Delta\overset{\circ}{e}_{xA \cdot A}$ more closely reflects the effect on an individual who is either cured of a disease or for whom the onset of the disease is prevented.

RESULTS

We will make comparisons of several dimensions of the cause of death structure across sex, time, and country using the various life table measures defined above.

Changes in Life Expectancy at Birth and at Age 65: 1950-1978

A basic and useful comparison to be made across countries is the level of life expectancy reached in our 11 countries, and the magnitude of changes in life expectancy 1950-1978. These values are presented both for birth and for age 65, in Table 3.

TABLE 3 BOUT HERE

In Table 3 we see that for all countries the life expectancy at birth is greater for females than males in 1950, that the life expectancy at birth increased significantly in all cases, and that the increases were larger for females than males. Thus, the gap between male and female life expectancy was increasing through 1978.

For male life expectancy at age 65 the pattern of change is more complex. For males, eight countries (Czechoslovakia, Denmark, West Germany, Hungary, Norway, Sweden, Great Britain, and Canada) had either small increases (less than one year) over the interval 1950 to 1978 or, in three cases, declines (Hungary, Czechoslovakia, and Norway). Of the three countries with male life expectancy increases of greater than one year at age 65 (Japan 3.5 years; France 1.9 years; U.S. 1.3 years), only Japan had an increase greater than the average increase for females (3.5 versus 2.8 years).

For females no country had an actual decline in life expectancy at age 65. Indeed the life expectancy increases at age 65 were much larger than for males with only Hungary and Czechoslovakia having increases of less than 1.5 years. Excluding these two countries the average increase for females was 3.2 years with the largest increase (4.5 years) occurring in Japan. The increase of 3.5 years for older U.S. females was only the fourth greatest increase. The average increase in female life expectancy at birth (excluding Hungary and Czechoslovakia) was 7.4 years. Thus, the average increase of 3.2 years at age 65 for these countries suggests that the gain in female life expectancy at age 65 in these countries is sizeable even when compared to the life expectancy gain at birth. If Japan's large increase in female life expectancy at birth is excluded then the gain in life expectancy at age 65 is nearly 50 percent as large as at birth (3.0 years versus 6.1 years).

The sex differences in the magnitude and timing of life expectancy increases above age 65 are interesting in several regards. First, they indicate that the largest and most rapid increases are occurring, within each country, for the population component with the greatest life expectancy (that is, females). Indeed two of the countries with the smallest increases in female life expectancy at advanced ages (Hungary and Czechoslovakia) have the lowest female life expectancies at birth. Thus, the rate of change in life expectancy at advanced ages does not yet provide evidence of any effect of intrinsic limits to human life span. Environmental factors seem to induce greater variability. For Japanese females, the life expectancy has continued to increase through 1981, and

currently exceeds 79.1 years at birth (73.8 for males; Koizumi, 1982).

Second, the timing of the changes in life expectancy at age 65 are interesting. For females, increases occur consistently across the study intervals for most countries. In contrast, for the three countries with the largest increases in male life expectancy at age 65 there seems to be a disproportionately large increase over the interval 1970-1978. In the U.S. for example, we know that male mortality rates actually increased an average 0.1 percent per year from 1954 to 1968. In the U.S. decreases in mortality associated with declines in heart disease and stroke risks began after 1968.

The countries under study have among the highest life expectancies at birth and age 65 in the world. Clear differences between males and females are manifest for the level, and degree of change of life expectancy at age 65. In subsequent cause specific analyses we will attempt to explain these changes in total mortality and life expectancy in terms of cause specific mortality patterns and trends.

One country in this group deserves special note--Japan. This is because Japan is the single country that, in 1950, had mortality conditions similar to that of the more advanced developing countries, that is, male life expectancies of 57.7 years at birth and 11.1 years at age 65, and female life expectancies of 61.0 years at birth and 13.2 years at age 65. The increase in life expectancy at-birth was 15.5 years for males and 17.5 years for females with similar increases occurring over the various study periods except for the extremely large increases of 9.4 years in life expectancy at birth for females and 7.8 years for males in the interval 1950-60. By 1978, this pattern of increase had produced the

highest male life expectancy at birth (73.2) and at age 65 (14.6) and one of the highest female life expectancies (78.5). By 1981, these life expectancies at birth had increased to 73.8 and 79.1 years for males and females (Koizumi, 1982).

Changes in Cause Specific Mortality Patterns: 1950-1978

In this section we will analyze measures of two dimensions of the cause specific mortality structures for the 11 countries, that is, ℓ_{xA}, the number of persons from an initial cohort of 100,000 persons who would be expected to die from a given cause under current mortality conditions, and $\overset{\circ}{e}_{xA}$, the mean age at death for those conditions in a cohort. In Table 4 we can examine the change, 1950-78, in these two parameters for three major chronic diseases: cancer, heart disease, and diabetes mellitus.

TABLE 4 ABOUT HERE

We selected these three particular chronic conditions because they are major components of the total force of mortality at advanced ages and because they have different public health and clinical characteristics. Cancer is a condition that is frequently lethal after a moderately long period of morbidity. Currently the most effective response is primary prevention, such as smoking cessation. Heart disease, on the other hand, kills a large number of persons suddenly (about 30 percent of the first myocardial infarctions are fatal in the U.S. (Hartunian and others, 1981)). The majority of persons, however, survive the first episode and often live long, relatively normal lives thereafter. Diabetes mellitus is a chronic condition that used to be an acute cause of death but which, with the advent of insulin therapy, should only be a contributory or associated cause of death. The level of disability

associated with diabetes, and the morbid consequences of the disease, seem to be manageable with good nutrition and careful medical management. Diabetes mellitus is a risk factor for other, primarily circulatory diseases.

For males we see that for the entire interval 1950-78 the mean age at death for cancer has increased for all but one country (Hungary). This suggests that males are dying at later ages of cancer in most countries even though, as we shall see later, the life expectancy gain that could be achieved by eliminating cancer has increased.

In 1950 two countries stand out in terms of the proportion of total male mortality that could be attributed to cancer--Japan and Norway. In Japan in 1950 only 10.1 percent (after proportional allocation of senility and ill-defined conditions) could be attributed to cancer. In Norway in 1950, over twice as many cancer deaths, 20.2 percent, could be expected to occur in a cohort subjected to current mortality conditions. The 1950 mortality structure for the selected European countries imply relatively high proportions of cancer deaths (16 to 18 percent) when compared with Canada (14.1 percent) and the U.S. (13.4 percent). In 1978 all of the countries had a mortality structure where 20 percent or more of total male deaths could be expected to result from cancer with France (26.5 percent) and Denmark (24.2 percent) being the highest.

For females, consistent with their larger overall increase in life expectancy, the mean age at death from cancer has increased in all countries. The proportions of deaths in each country attributable to cancer for females in 1950 is similar to, and often higher than, the

corresponding proportion for males. By 1978, however, though the proportion of deaths expected to be due to cancer in the female population generally increased, the proportions were lower in all cases than for males. This greater increase in the proportionate effect of cancer mortality for males 1950 to 1978 can probably be traced to the rapid rise of lung cancer mortality among males due to increased tobacco consumption.

For heart and hypertensive diseases we find considerably greater variation across countries than for cancer suggesting a greater dependence of circulatory diseases on lifestyle, nutrition, and environmental factors (and also probably greater differences in diagnostic custom). For males the proportion of mortality expected to be due to heart disease under the mortality structure observed in 1950 varied from 8.1 percent in Japan to 40.0 percent in the U.S. By 1978, the percentage of deaths expected to be due to heart and hypertensive diseases in Japan had risen only marginally--to 11 percent. France also had a remarkably low heart disease mortality component of 5.1 percent in 1950 rising to only 12.0 percent in 1978. The trend in the significance of heart disease varied greatly with both significant increases (in Sweden going from 27.5 percent to 39.1 percent) and decreases (in the U.S. going from 40.0 percent to 36.9 percent). Generally, however, because heart diseases are prevalent among the elderly the trend is upward with seven of 11 countries showing increases.

We also found that the mean age at death due to heart disease has declined in six countries (Czechoslovakia, Denmark, West Germany,

Hungary, Norway, and Great Britain)--in some cases quite markedly, (Hungary's drops 4.1 years). In contrast, in Japan the mean age at death from heart disease increased 8.4 years. It seems that the failure of males to markedly improve life expectancy at age 65 in a number of countries can be attributed to the decline in the mean age at death from heart disease.

For females the proportionate contribution of heart disease to mortality is similar to that for males. For example, both Japan and France have extremely low contributions in 1950 and, though increasing, remain low in 1978. U.S. females, like their male counterparts, had the highest proportion of total mortality due to heart disease with the difference being, for females, that the proportion declined very little. The most striking difference between males and females is the general increase in the expected mean age at death for females. In only two cases (Hungary and Great Britain) did this not change much. In other cases the change was considerable (Japan, 10.03 years; U.S., 5.44 years). Thus, the big increases in female life expectancy at advanced ages seem attributable to an increase in the mean age at death from heart disease--generally to 80 or more years.

Diabetes mellitus is a much smaller factor in total mortality than either of the first two conditions. In developed countries, this disease is often viewed as a risk factor for other circulatory diseases because it is usually possible to alleviate its acute risk and to manage its long-term effects. In examining diabetes mortality for males, however, we see that there has been an increase in the percentage of mortality attributable to diabetes in all countries except Norway. The increase

in Japan is over fourfold. Likewise, there is an increase in the mean age at death from diabetes for all countries ranging from nearly no increase for Norway to 10.4 years for Japan.

For females, diabetes is a proportionately more important cause of death than for males. Only in Norway and the U.S. has this contribution decreased. For other countries the increases vary from very large (over a fourfold change in Japan) to negligible (Great Britain). Another major difference in the female diabetes mortality pattern are the increases in the mean age at death--increases that are much greater than for males and to much greater levels than for males.

A Comparison of the Effects of Eliminating Causes of Death on Survival

As indicated in the methods section, we calculated the impact of hypothetically eliminating a cause of death in two ways. The first way ($\Delta\mathring{e}_{x \cdot A}$) averages the person-year gain over all persons in the population. The second way ($\Delta\mathring{e}_{xA \cdot A}$) averages the same total person-year figure over only those persons who actually died of the condition. Thus, the second figure is adjusted for differences in the prevalence at death of the condition (that is, ℓ_x/ℓ_{xA}) and is more representative of the effects of the condition on an individual possessing the condition. These figures are shown in Table 5 for five major chronic conditions for five selected countries.

TABLE 5
ABOUT HERE

One general observation that can be made from the table is that the $\mathring{e}_{xA \cdot A}$ gain is much less variable than $\mathring{e}_{x \cdot A}$. For example, though the life expectancy gain that could be achieved by eliminating cancer increases from 1.89 to 3.01 years for U.S. males, the effect on any given individual increased only slightly--from 14.07 to 14.50 years. Thus,

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the majority of the increase in the person-year effect of cancer is due to an increased prevalence at death. The effect on the life expectancy of any given individual is remarkably similar in the two years. This observation holds true across countries as well. Even in Japan in 1950, when the male life expectancy was a little over 57 years, the expected change in an individual's life expectancy due to the hypothetical elimination of cancer was 13.2 years, a figure that is comparable with the values over the five countries in 1978. A similar cross-country comparison made for other causes of death indicates remarkable constancy in the impact of chronic conditions on the individual life span across very different mortality levels and cause of death structures.

In evaluating the mortality pattern for U.S. males we see that there were major declines in the standard measure of the gain in life expectancy due to the elimination of both stroke and heart disease. This is consistent with the major reduction in stroke and chronic heart disease mortality rates 1968 to 1978 (note the majority of the decrease occurred after 1970). In contrast, there was a large increase in the effects of cancer (increasing from 1.89 to 3.01 years). The only cause of death that manifested a significant increase in $\overset{\circ}{e}_{xA \cdot A}$ was cirrhosis, which, combined with a large increase in $\overset{\circ}{e}_{x \cdot A}$, suggests that both the prevalence at death and the impact on individual life expectancy increased.

For U.S. females the mortality patterns were quite different. For example, for three diseases (cancer, heart disease, and cirrhosis) the impact on individual life expectancy increased significantly (compared to only cirrhosis for males). Also, in contrast to males, the standard

measure of life expectancy gain increased for heart disease. As for males the life expectancy effect of cancer increased. For females the effects of eliminating cancer and cirrhosis on the individual was greater than for males. In other words, these two diseases shortened the life span of an average female more than an average male.

There are some major differences between Japanese and U.S. males--the most notable being in both types of life expectancy gain measures for heart disease. In Japan the standard life expectancy gain measure is less than a fifth of what it is for U.S. males reflecting, in large part, a much lower reported prevalence at death. In addition, the impact on individual life expectancy is 4.47 years less in Japan in 1950--a difference that increases to 6.12 years in 1978. Thus, there are differences in mortality risks for heart disease between the U.S. and Japan which reflect differences both in the prevalence at death of heart disease (much lower in Japan) and in the number of years of increased life expectancy for persons dying of heart disease (with the Japanese gaining far less). The smaller effect on individuals for eliminating heart disease in Japan is due to the fact that the mean age at death from heart disease in Japan is much higher relative to all other causes of deaths than in the U.S.

A somewhat different pattern exists for stroke mortality. In 1950 the life expectancy gain expected in the population due to the elimination of stroke was 62 percent larger in Japan. By 1978 the life expectancy impact in Japan was 272 percent larger than in the U.S. For stroke, however, the effect on individual life expectancy (adjusted for

prevalence at death) changed little over time with no more than 12 percent difference between the two countries at any time. Thus, in contrast to heart disease, differentials between the U.S. and Japan in changes in the effect on individual life expectancy were of little consequence for stroke mortality.

Some similar patterns can be noted in comparing Japanese and U.S. females. For example, parallel to the males, stroke has a far greater impact in Japan (for example, in 1978, 3.78 years versus 1.59 years). Also both measures of the impact of heart disease on life expectancy are much less in Japan than in the U.S.

In Sweden, we find that heart disease mortality has an increasing effect in terms of both measures (in contrast to both Japanese and U.S. males). As in the U.S., stroke has had a significant drop in both life expectancy gain measures. Cirrhosis, as for Japan and the U.S., has increased markedly in impact in terms of the standard measure of life expectancy gain.

Swedish females show the same general pattern of changes in the impact on life expectancy as do Swedish males (that is, increases for cancer, heart disease, and cirrhosis and a decline for stroke)--a pattern similar to U.S. females though the effect of heart disease is considerably less.

Czechoslovakian males show, similar to U.S. males, a small decline in the life expectancy gain attributable to heart disease. Stroke mortality on the other hand shows an increased impact (in contrast to the U.S. and Sweden). Cirrhosis, as for males in all other countries, shows

an increased impact. Except for cirrhosis, the expected impact of these five diseases on the life span of the affected persons shows very little change over the interval 1950-78.

Czechoslovakian females show only a relatively small (compared to other females) increase in the life expectancy gain due to cancer elimination (similar to West Germany). Czechoslovakian females also show increases in the effect of eliminating stroke mortality and decreases in the effect of eliminating heart diseases.

West German males show a pattern similar to Sweden with increases in cancer, diabetes, and cirrhosis, and with decreases in stroke. As for males in other countries, the change in the effect on individuals increased markedly only for cirrhosis.

West German females show the same general cause specific pattern as West German males, except that their increase in the impact of heart disease is very small.

Cohort Mortality Trends

The cause specific patterns we have examined to this point have been cross-sectional. We know that, for certain causes of death, there are significant differentials in mortality rates across birth cohorts. To illustrate, we have plotted in Figure 1 the female age specific mortality rates ($_5q_x$) for stroke in Japan for cohorts aged 35, 45, and 55 in 1948 (the birth cohorts of 1913, 1903, and 1893 respectively) and followed to 1978 where they were aged 65, 75, and 85 respectively.

FIGURE 1 ABOUT HERE

In Figure 1 we can see that there has been a drop, over cohorts, in the probability of death due to stroke at specific ages. This

implies that some cohort specific factor is operational in the declines in the female risks of stroke.

In order to obtain a broader assessment of cohort effects, we present in Table 6 the cause and sex specific ratios of the probability of death between cohorts at specific ages for six countries (Japan, U.S., West Germany, Czechoslovakia, Norway, and France).

TABLE 6 ABOUT HERE

For males, we see no consistent cohort pattern for heart disease in the four European countries examined. For both the U.S. and Japan, in contrast, there is a fairly consistent pattern of cohort decreases in heart disease mortality rates. There is a mix of cohort differences for cancer which are largest between the 1893 and 1903 cohorts. In four of the six countries (Japan, West Germany, Czechoslovakia, and France) there is a tendency for the 1913 cohort to have lower risks than the 1903 cohort--and, even for the ratios that increase, the increases between the 1913 to 1903 cohorts are smaller than between the 1903 to 1893 cohorts. For stroke, three countries (U.S., West Germany, and France) show consistent and large cohort decreases in stroke mortality. For Norway, Japan, and Czechoslovakia, there is a mixed pattern of increases and decreases.

The heart disease mortality pattern for females showed pronounced cohort declines for the U.S. and Japan. For the other four countries, the patterns are mixed with some age specific increases. For cancer, Japan, France, and Czechoslovakia exhibit consistent cohort declines. For stroke four countries (U.S., Japan, West Germany, and France) show consistent and large decreases in mortality across cohorts.

The Correlation of Morbidity, Disability, and Mortality

As discussed in the introduction it is important to link mortality patterns with underlying chronic disease and disability. This is necessary to determine if mortality reductions are occurring because of improvements in the age specific health status of the population or if they are simply being achieved by the prolongation of diseased and disabled lives. Although we do not currently have mortality and morbidity data to determine the temporal direction of such relations it is useful to examine the ways in which such relation might be simply measured and studied.

The relation of morbidity, mortality, and disability can be studied through one of two types of analyses. One approach, which we can refer to as bioactuarial modeling, combines population data on the time and age variation of mortality rates of the disease of interest with biomedical information on the natural history and rate of progression of that disease (Manton and Stallard, 1982b).

A second approach is to use an extension of the basic life table proposed by Koizumi (1982). Koizumi proposed that survey estimates of the age specific prevalence of chronic diseases (with and without limitations) could be combined with life table estimates of the age specific probability of survival to portray mortality, morbidity, and disability as a series of interrelated survival curves. He illustrated this procedure using Japanese life tables for 1979 and three population surveys. Using data from the 1981 National Medical Expenditures Survey, and recent NCHS life tables, we developed the illustration of these relations portrayed in Figure 2.

FIGURE 2 ABOUT HERE

In Figure 2 we have plotted the age change in the probabilities of a.) survival (obtained from 1978 U.S. life tables), b.) the probability of being alive and free of heart and hypertensive diseases (conditional upon the probability of living to age x from the life table), and c.) the probability of being alive with heart and hypertensive disease and disability (conditional upon living to age x from life table). As can be seen from the differences between plot lines A and B, the prevalence of heart disease increases at ages before mortality begins to increase rapidly. Also, from the relative position of plot line C, we see that the age specific prevalence of disability, even among persons with heart or hypertensive diseases, does not increase until late in the life span.

With an appropriate time series of data we would wish to determine if the age specific distance between the curves increased or decreased as life expectancy increased. If the distance were to decrease, then though the problems of population aging would increase due to the increasing size of the elderly population, the health status of any individual would be expected to improve at each age.

DISCUSSION

The results of our analyses show that major increases in life expectancy have occurred at advanced ages for females and that the cross-country differences in the cause of death structure indicate that advances were achieved through a variety of mechanisms. Thus, it appears that no single uniform model of biological aging will currently explain cause specific mortality trends in countries with historically high life expectancies. This implies that further mortality reductions are possible

in these countries by achieving cause specific mortality reductions observed to have occurred in another country.

In examining the differences in the cause specific patterns across the 11 countries, we found persistent patterns that suggest certain principles for the development of a theory of mortality change in developed countries. On one hand, cancer mortality seems to affect most developed countries to the same degree (with 20 to 25 percent of mortality attributable to cancer in countries with $\mathring{e}_0 > 70.0$ years). Thus, though actually a heterogeneous collection of diseases, cancer appears to be strongly dependent on basic physiological aging processes. In contrast, the proportion of deaths due to heart disease and stroke varied considerably over countries suggesting a mugh greater dependence of these diseases on environmental factors. This suggests that while there is some potential that heart disease and stroke mortality can be significantly reduced in developed countries, cancer mortality will tend to rise (given current technology).

In addition to a characterization of mortality patterns in terms of the proportionate contribution of specific diseases, one also needs to consider the pattern of changes in the mean ages at death from those conditions. In this regard, it is notable that those countries with the greatest life expectancy changes also exhibited some of the largest increases in the mean ages at death from heart disease and stroke. Thus, though elimination of circulatory disease is not likely, significant delays in the age at which a person dies from those conditions may be possible. At the life expectancy level currently being experienced in

developed countries, we find the predominant dynamics in the health state of the population to be: a.) delays in the age at death from circulatory disease, and b.) shifts in the proportionate structure of mortality as more persons die of cancer due to the delay of circulatory disease death. This characterization of the current dynamics of the health state of developed-country populations is consistent with the differential abilities of our health care system to treat and prevent circulatory and neoplastic diseases. Should these dynamics persist, cancer may compete with heart disease to become the number one ranked cause of death in developed countries. This, of course, will depend on cancer mortality risks rising rapidly with age. Certain investigators have found, however, that the age increase in cancer mortality risks tends to flatten at advanced ages in U.S. period mortality data (Brody, 1983). Other investigators have noted similar patterns for certain cancer types (Cook and others, 1969) and in cohort data (Manton and Stallard, 1982b). Thus, the development of a theory of the "epidemiological transition" for developing countries needs to take into account new evidence about the dependency of chronic disease risks on the underlying physiological aging processes.

Population aging is not a phenomenon limited to developed countries. For example, the magnitude of population aging for developed and developing countries may be seen in the U.N. population estimates and projections for both developed and developing regions of the world (Siegel, 1982). In 1980, there were actually more persons over age 60 alive in developing countries (205.3 million) than in developed countries (170.5 million). This differential is projected to increase; in 2020, there

will be more than twice as many persons over age 60 in developing countries (679.2 versus 296.3 million). What is perhaps more surprising is that the numbers of persons over age 80 is growing proportionately even faster than the population over age 60. Beginning with 14.4 million in developing countries and 20.9 million in developed countries in 1980, the 80+ population projects to 58.2 million and 43.3 million by 2020 (growth rates of 404 and 207 percent versus 331 and 174 percent for the 60+ population).

What makes the problems of population aging complex is that the rate of population aging is accelerated by two conscious strategies to improve health and social conditions. The first strategy employed in many developing countries is the implementation of population control and family planning programs which have been very successful in many cases leading to reductions in birth rates and, consequently, to smaller birth cohorts. Success in population control leads to an acceleration of structural population aging, that is, to a faster increase in the proportion of the population that is elderly. The second strategy involves public health and clinical programs that have produced increases in life expectancy in a number of countries by reducing the mortality rates of many diseases. For example, it is a major goal of WHO's program of Health For All by the year 2000 that all countries of the world will have a life expectancy at birth of at least 60 years. Such mortality reductions have the effect of accelerating the growth of the absolute size of the elderly population and, especially, of the very elderly (age 85+) population. What is not adequately appreciated is how rapidly the effects of population control can induce major changes in the mix-

ture of public health problems facing a society. For example, in Shanghai County, China, where declines in fertility occurred during the period 1960-80, cancer became the first ranked cause of death (from sixth in 1960) while infectious diseases dropped to the sixth rank (Xing-Yuan and Mai-ling, 1982). Life expectancy in Shanghai County rose from 61.8 years at birth in 1960 for males and 67.3 years for females to 69.7 and 75.2 years at birth in 1980. Thus, the evaluation of changes in chronic disease mortality patterns will be an important aspect of the study of population aging in developing as well as developed countries.

TABLE 1

Percentage Of The Total Number Of Deaths Occurring After Age 65 Assigned To Senility And Ill-Defined Conditions

Country	1950	1955	1960	1965	1970	1975	1978
				MALES			
Canada	2.30	1.54	1.05	0.81	0.63	0.95	0.93[a]
U.S.	1.58	1.20	1.07	1.10	1.04	1.19	1.22
Japan	18.21	17.72	12.94	10.14	7.35	5.42	4.93
Czechoslovakia	14.19[b]	9.34	4.04	2.41	1.49	0.89	--
Denmark	2.50[c]	1.34	1.52	1.22	1.33	2.18	2.87[d]
France	23.67	20.34	16.09	14.47	9.97	6.97	6.23[e]
West Germany	12.17[f]	10.23	8.26	6.03	3.87	3.45	3.24
Hungary	--	18.02	6.61	1.80	0.46	0.07	0.04
Norway	9.73[g]	8.33	7.07	6.40	5.39	5.19	5.45
Sweden	11.93[h]	5.28	2.00	0.94	0.60	0.32	0.29
Great Britain	2.36	1.96	1.41	0.83	0.48	0.32	0.25
				FEMALES			
Canada	3.03	2.11	1.52	0.86	0.79	1.25	1.06
U.S.	1.55	1.08	0.97	0.96	0.90	1.10	1.17
Japan	24.05	24.66	19.40	16.96	13.11	9.48	8.43
Czechoslovakia	17.59	11.85	5.34	3.62	2.47	1.55	--
Denmark	3.07	1.40	1.91	1.29	1.31	2.39	3.07
France	25.76	23.09	18.86	17.50	13.00	9.76	8.83
West Germany	14.69	12.51	10.22	7.78	4.86	4.02	3.90
Hungary	--	20.63	7.86	2.31	0.77	0.17	0.06
Norway	12.13	9.66	7.89	6.50	4.68	4.27	4.61
Sweden	12.54	6.32	2.92	1.40	0.82	0.43	0.41
Great Britain	3.59	3.05	2.48	1.55	1.08	0.76	0.66

[a] 1977 value
[b] 1953 value
[c] 1952 value
[d] 1979 value
[e] 1977 value
[f] 1952 value
[g] 1951 value
[h] 1951 value

TABLE 2

Sixth, Seventh, And Eighth Revisions Of International Classification Of Disease Codes Used To Define Our Diagnostic Categories

	6th and 7th Revision	8th Revision	Comparability Rates[a]
Cancer	140-205 (A44-A59)	140-209 (A45-A60)	1.0017
Heart and Hypertensive Disease	420-422, 440-443, 444-447, (A81, A83, A84)	410-414 400-404 (A82,A83)	0.9958
Stroke	330-334 (A70)	430-438 (A85)	0.9905
Cirrhosis	581 (A105)	571 (A102)	1.0055
Diabetes	260 (A63)	250 (A64)	0.9971

[a]Based on Comparability Study for 7th and 8th Revisions conducted by NCHS (Klebba, 1975).

(WHO List A categories in parentheses)

TABLE 3

Life Expectancy Change 1950-1978 At Birth And Age 65

Country	At Birth				At Age 65			
	1950	1960	1970	1978	1950	1960	1970	1978
				MALES				
Canada	66.23	68.14	69.25	70.54	13.35	13.34	13.67	14.23
U.S.	65.40	66.64	67.14	69.54	12.81	12.93	13.18	14.06
Japan	57.66	65.50	69.44	73.17	11.08	11.75	12.66	14.63
Czechoslovakia	64.65	67.83	66.20	66.95[b]	12.01	12.79	11.41	11.69[b]
Denmark	69.46	70.51	70.93	71.35	13.72	13.68	13.84	13.76
France	63.96	67.55	69.09	70.23	12.18	12.60	13.36	14.09
West Germany	65.56	66.52	67.29	69.18	12.71	12.19	11.98	12.71
Hungary	64.96[a]	65.99	66.38	66.11	12.77[a]	12.37	12.01	11.71
Norway	70.87	71.33	71.02	72.40	15.10	14.42	13.81	14.29
Sweden	70.05	71.25	72.27	72.48	13.67	13.75	14.35	14.23
Great Britain	66.59	68.24	68.80	70.07	12.02	12.20	12.03	12.61
				FEMALES				
Canada	70.46	73.86	76.09	78.13	14.91	15.80	17.29	18.60
U.S.	70.96	73.23	74.63	77.33	15.07	15.90	16.84	18.55
Japan	60.96	70.35	74.82	78.50	13.15	14.24	15.50	17.66
Czechoslovakia	69.15	73.23	73.01	74.91[b]	13.48	14.74	14.38	14.85[b]
Denmark	72.23	74.02	76.04	77.56	14.51	15.11	16.71	17.73
France	69.65	74.08	76.62	78.44	14.64	15.67	17.29	18.45
West Germany	69.73	71.86	73.62	75.94	13.84	14.23	15.03	16.36
Hungary	68.83[a]	70.26	72.17	72.77	13.95[a]	13.88	14.43	14.50
Norway	74.39	75.79	77.39	78.74	16.05	15.97	16.83	17.84
Sweden	72.72	74.91	77.32	78.81	14.49	15.33	17.07	17.92
Great Britain	71.33	74.14	75.09	76.19	14.42	15.45	15.98	16.64

[a] Value for 1955

[b] Value for 1975

TABLE 4

Changes 1950 To 1978 In The Mean Age At Death And Proportion Affected By The Disease For Cancer, Heart And Hypertensive Disease, And Diabetes Mellitus

Country	1950 ℓ_{0A}	1950 $^{o}e_{0A}$	1960 ℓ_{0A}	1960 $^{o}e_{0A}$	1970 ℓ_{0A}	1970 $^{o}e_{0A}$	1978 ℓ_{0A}	1978 $^{o}e_{0A}$
				MALES				
				A. Cancer				
Canada	14,133	68.57	16,459	69.39	18,307	70.00	21,280	70.74
U.S.	13,400	67.13	15,086	67.23	17,069	67.88	20,772	69.88
Japan	10,113	64.64	15,031	66.06	17,417	67.59	21,245	70.30
Czechoslovakia	16,250	66.27	19,489	66.92	20,022	66.74	21,509[b]	66.99[b]
Denmark	18,863	69.79	20,808	70.08	20,952	69.60	24,215	70.29
France	17,729	67.13	21,299	68.14	23,492	68.71	26,502	69.09
West Germany	18,321	68.72	18,823	68.11	19,829	68.43	22,589	69.54
Hungary	15,659[a]	68.05[a]	16,505	67.73	18,555	68.11	20,114	67.36
Norway	20,155	70.89	18,677	70.06	19,095	70.09	21,653	71.89
Sweden	16,350	69.97	17,575	70.20	18,967	71.81	21,370	72.43
Great Britain	16,546	66.46	19,229	67.07	20,864	67.97	23,369	69.05
				B. Heart Disease				
Canada	36,735	72.57	40,115	72.32	37,045	72.87	35,446	73.61
U.S.	40,021	71.14	41,328	71.49	39,197	72.11	36,887	73.89
Japan	8,146	69.32	11,811	72.57	9,973	74.34	10,975[b]	77.71[b]
Czechoslovakia	28,570	74.12	22,312	72.66	25,431	70.47	25,788[b]	70.90[b]
Denmark	28,356	75.13	31,765	74.51	35,881	74.83	36,890	74.35
France	5,135	69.50	10,348	71.46	10,638	71.26	12,013	72.49
West Germany	19,122	72.50	21,550	70.91	18,050	70.09	23,956	71.93
Hungary	22,256[a]	74.48[a]	24,286	73.76	23,302	72.09	25,334	70.36
Norway	20,782	75.53	31,361	73.99	33,268	72.49	32,863	72.79
Sweden	27,515	75.13	34,498	75.33	37,996	75.98	39,053	75.45
Great Britain	32,734	73.47	32,431	72.21	29,132	70.05	31,949	70.70
				C. Diabetes				
Canada	946	69.90	1,203	70.63	1,597	72.57	1,456	73.95
U.S.	1,198	68.46	1,302	68.57	1,530	69.75	1,378	71.42
Japan	292	62.47	449	67.19	1,030	69.77	1,242	72.86
Czechoslovakia	730	67.53	774	68.55	911	68.08	805[b]	68.90[b]
Denmark	371	64.37	668	67.27	869	70.84	935	70.06
France	684	64.76	922	70.15	1,226	72.15	1,314	72.89
West Germany	809	69.33	887	69.85	1,875	70.74	1,674	71.38
Hungary	439[a]	67.61[a]	517	67.05	411	67.04	779	68.41
Norway	912	70.78	775	68.57	718	69.59	769	70.97

Sweden	832	68.92	1,089	69.18	1,118	70.17	1,171	70.99
Great Britain	477	69.19	453	69.78	596	70.25	675	70.81
				FEMALES				
				A. Cancer				
Canada	15,525	67.68	16,867	69.36	17,978	70.84	19,038	72.19
U.S.	15,224	67.39	15,262	68.35	16,014	69.26	18,421	71.38
Japan	9,790	64.30	13,448	67.09	14,225	68.53	15,866[b]	71.46[b]
Czechoslovakia	15,377	67.06	16,477	68.29	16,187	68.47	16,653[b]	69.14[b]
Denmark	19,564	69.35	21,107	70.05	21,326	70.35	24,177	71.77
France	18,146	69.88	19,548	71.03	19,132	72.44	19,585	73.40
West Germany	19,096[a]	69.31[a]	18,797	69.43	18,817	69.77	20,248	71.47
Hungary	15,703[a]	68.07[a]	15,801	67.97	16,544	68.71	17,586	69.16
Norway	20,050	71.00	17,527	69.76	17,612	70.47	19,465	72.29
Sweden	15,930	68.80	16,845	68.93	18,590	71.68	20,608	73.19
Great Britain	15,613	67.91	16,415	68.72	17,545	69.10	19,043	69.87
				B. Heart Disease				
Canada	34,324	77.44	37,017	78.70	35,476	80.78	34,245	82.24
U.S.	38,935	76.87	40,428	78.41	39,472	79.90	38,085	82.31
Japan	9,987	72.65	14,085	76.63	11,206	79.29	12,994[b]	82.68[b]
Czechoslovakia	32,175	77.47	23,924	78.07	25,847	77.79	26,587[b]	78.58[b]
Denmark	27,839	78.27	28,033	78.91	30,762	80.80	32,519	81.87
France	4,285	75.28	9,841	78.54	19,132	72.44	11,090	80.82
West Germany	20,910	76.21	21,526	76.60	15,258	77.61	21,346	79.66
Hungary	26,498[a]	77.64[a]	28,100	77.11	24,863	77.71	26,866	77.49
Norway	20,194	79.13	26,536	79.24	25,887	79.88	24,222	80.42
Sweden	27,734	78.11	32,929	79.56	35,036	81.59	34,837	82.47
Great Britain	34,796	78.64	32,416	79.41	23,240	78.23	24,780	78.59
				C. Diabetes				
Canada	1,889	70.69	2,090	73.09	2,687	76.22	2,471	78.38
U.S.	2,360	70.22	2,346	71.86	2,618	74.08	2,248	76.88
Japan	299	62.73	533	66.95	1,140	71.00	1,436[b]	75.30[b]
Czechoslovakia	1,180	68.80	1,804	71.71	2,088	71.89	1,614[b]	72.87[b]
Denmark	676	67.13	806	69.37	1,451	73.63	1,258	76.75
France	1,188	68.86	1,676	73.83	2,102	76.37	2,113	78.52
West Germany	1,502[a]	71.08[a]	1,753	72.77	3,503	74.98	2,932	76.35
Hungary	692[a]	67.24[a]	998	69.64	928	71.54	1,736	72.81
Norway	1,307	75.50	1,128	75.50	935	76.42	1,1[illegible]3	79.41
Sweden	1,451	71.27	1,581	72.33	1,587	75.74	1,739	80.20
Great Britain	956	70.34	895	73.42	1,021	74.43	960	75.35

[a]Value for 1955

[b]Value for 1975

TABLE 5

Changes 1950 To 1978 In The Life Expectancy Gain Expected With The Elimination Of 5 Major Chronic Conditions In Both The General Population And Among Persons With The Disease At Death

Disease	1950		1960		1970		1978	
	$\Delta\mathring{e}_{x\cdot A}$	$\Delta\mathring{e}_{x\Lambda\cdot A}$	$\Delta\mathring{e}_{x\cdot A}$	$\Delta\mathring{e}_{x\Lambda\cdot A}$	$\Delta\mathring{e}_{x\cdot A}$	$\Delta\mathring{e}_{x\Lambda\cdot A}$	$\Delta\mathring{e}_{x\cdot A}$	$\Delta\mathring{e}_{x\Lambda\cdot A}$
MALES								
United States								
Cancer	1.89	14.07	2.14	14.22	2.47	14.50	3.01	14.50
Diabetes	0.15	12.33	0.16	12.48	0.19	12.43	0.17	12.32
Heart Disease	6.27	15.67	6.53	15.81	6.39	16.31	5.81	15.76
Stroke	1.16	10.70	1.11	10.21	1.05	10.75	0.85	10.52
Cirrhosis	0.17	16.99	0.23	17.61	0.34	19.10	0.32	19.37
Japan								
Cancer	1.33	13.17	2.01	13.35	2.35	13.52	2.97	13.96
Diabetes	0.04	13.83	0.05	11.58	0.11	11.07	0.14	11.15
Heart Disease	0.91	11.20	1.21	10.27	0.96	9.59	1.06	9.64
Stroke	1.88	10.49	3.27	11.48	3.59	11.60	3.16	11.52
Cirrhosis	0.14	12.74	0.21	12.17	0.31	14.63	0.39	16.30
Sweden								
Cancer	2.09	12.81	2.28	12.97	2.46	12.95	2.70	12.63
Diabetes	0.11	12.77	0.14	13.07	0.15	13.14	0.16	13.24
Heart Disease	3.02	10.98	4.16	12.06	5.03	13.24	5.21	13.33
Stroke	1.39	9.19	1.16	9.15	0.91	9.49	0.85	9.49
Cirrhosis	0.05	15.47	0.07	14.36	0.16	18.60	0.26	18.96
Czechoslovakia								
Cancer	2.21	13.59	2.78	14.29	2.62	13.07	2.84[a]	13.21[a]
Diabetes	0.08	11.47	0.09	11.82	0.10	10.92	0.08[a]	10.55[a]
Heart Disease	3.41	11.93	2.71	12.15	3.05	11.99	3.06[a]	11.85[a]
Stroke	0.88	9.64	1.03	9.66	1.22	9.50	1.39[a]	9.44[a]
Cirrhosis	0.10	12.90	0.15	13.78	0.24	14.60	0.31[a]	15.63[a]
West Germany								
Cancer	2.38	13.01	2.42	12.87	2.54	12.80	2.94	13.02
Diabetes	0.09	11.27	0.09	10.59	0.19	10.22	0.17	10.40
Heart Disease	2.14	11.21	2.50	11.58	2.22	11.80	2.86	11.95
Stroke	1.57	9.26	1.41	8.78	1.20	8.95	1.10	8.97
Cirrhosis	0.16	14.36	0.26	12.72	0.38	14.32	0.54	16.83
FEMALES								
United States								
Cancer	2.48	16.31	2.50	16.37	2.70	16.83	3.25	17.65
Diabetes	0.31	13.12	0.30	12.81	0.33	12.63	0.29	13.11
Heart Disease	5.72	14.70	5.83	14.42	5.88	14.90	6.41	16.83
Stroke	1.69	11.38	1.71	10.67	1.69	10.94	1.59	11.94
Cirrhosis	0.12	18.88	0.15	21.47	0.23	23.48	0.21	23.40

TABLE 5 (cont'd.)

				Japan				
Cancer	1.54	15.69	2.06	15.34	2.19	15.42	2.48	15.64
Diabetes	0.05	15.90	0.08	14.20	0.14	12.54	0.17	11.73
Heart Disease	1.17	11.68	1.46	10.35	1.00	8.93	1.20	9.20
Stroke	2.48	11.40	3.80	11.95	3.97	11.60	3.78	11.89
Cirrhosis	0.11	13.28	0.15	11.87	0.15	13.02	0.15	13.48
				Sweden				
Cancer	2.30	14.42	2.56	15.20	2.86	15.36	3.16	15.32
Diabetes	0.16	11.62	0.19	11.99	0.18	11.57	0.17	9.79
Heart Disease	2.81	10.12	3.59	10.89	4.32	12.32	4.34	12.47
Stroke	1.85	9.80	1.56	9.36	1.32	9.89	1.32	9.82
Cirrhosis	0.05	18.22	0.06	16.19	0.08	16.49	0.12	18.86
				Czechoslovakia				
Cancer	2.24	14.60	2.50	15.14	2.37	14.61	2.42[a]	14.56[a]
Diabetes	0.14	11.91	0.21	11.42	0.23	10.93	0.17[a]	10.64[a]
Heart Disease	3.57	11.09	2.53	10.57	2.66	10.28	2.71[a]	10.19[a]
Stroke	1.07	9.42	1.33	9.63	1.79	9.63	2.06[a]	9.70[a]
Cirrhosis	0.07	12.68	0.09	13.20	0.11	13.77	0.12[a]	13.63[a]
				West Germany				
Cancer	2.65	13.88	2.62	13.96	2.74	14.57	3.00	14.80
Diabetes	0.17	11.15	0.18	10.27	0.34	9.82	0.30	10.14
Heart Disease	2.12	10.16	2.12	9.83	1.46	9.56	2.17	10.17
Stroke	2.09	9.58	2.01	9.04	1.75	9.11	1.71	9.39
Cirrhosis	0.08	12.92	0.14	11.66	0.18	13.71	0.25	17.88

[a]Values for 1975

TABLE 6

Sex And County Specific Ratios Of Cohort Probabilities Of Death For Three Major Chronic Diseases

Country	At Age	Heart Disease 1913/1903	Heart Disease 1903/1893	Cancer 1913/1903	Cancer 1903/1893	Stroke 1913/1903	Stroke 1903/1893
				MALES			
Japan	45	.83	---	1.00	---	1.27	---
	55	.71	1.01	.95	1.06	.68	1.38
	65	.72	.79	.95	1.02	.56	.85
	75	---	.85	---	1.13	---	.68
United States	45	.97	---	1.00	---	.79	---
	55	.92	.95	1.11	1.13	.86	.76
	65	.77	.93	1.05	1.14	.64	.85
	75	---	.88	---	1.20	---	.74
West Germany	45	2.64	---	1.00	---	.92	---
	55	.92	1.33	.95	1.05	.83	.87
	65	1.09	.92	.94	1.11	.75	.85
	75	---	1.23	---	1.12	---	.85
Czechoslovakia	45	1.06	---	.97	---	.53	---
	55	1.35	.98	.96	1.19	1.67	.91
	65	---	1.34	---	1.13	---	1.53
	75	---	---	---	---	---	---
France	45	1.45	---	.88	---	.71	---
	55	.98	1.54	.99	1.10	.84	.77
	65	.94	1.03	1.05	1.09	.70	.91
	75	---	1.08	---	1.09	---	.76
Norway	45	2.04	---	.70	---	1.08	---
	55	1.28	1.81	1.16	.90	1.23	.67
	65	.90	1.17	1.08	1.13	.64	1.07
	75	---	.99	---	1.07	---	.74
				FEMALES			
Japan	45	.67	---	.88	---	.85	---
	55	.40	.83	.86	1.00	.62	.97
	65	.60	.67	.91	.92	.56	.74
	75	---	.85	---	1.00	---	.67
United States	45	.80	---	1.00	---	.64	---
	55	.85	.76	1.07	.88	.78	.67
	65	.70	.86	1.00	1.04	.60	.80
	75	---	.84	---	1.11	---	.75
West Germany	45	1.00	---	1.14	---	.79	---
	55	.57	1.00	1.00	.94	.64	.74
	65	1.00	.67	.93	.97	.71	.66
	75	---	1.15	---	.96	---	.78
Czechoslovakia	45	.57	---	.97	---	.57	---
	55	1.06	.75	.99	.97	1.38	.76
	65	---	1.10	---	.94	---	1.26
	75	---	---	---	---	---	---
France	45	1.00	---	.93	---	.62	---
	55	.92	1.26	.98	.91	.73	.63
	65	.85	.95	.96	.88	.64	.76
	75	---	1.04	---	.93	---	.75
Norway	45	1.25	---	.79	---	1.25	---
	55	1.06	1.13	.92	1.01	.56	.96
	65	.86	.95	1.13	.89	.66	.69
	75	---	.92	---	1.07	---	.83

FIGURE 1

Age Specific Mortality Rates For Stroke For
Three Selected Japanese Female Cohorts

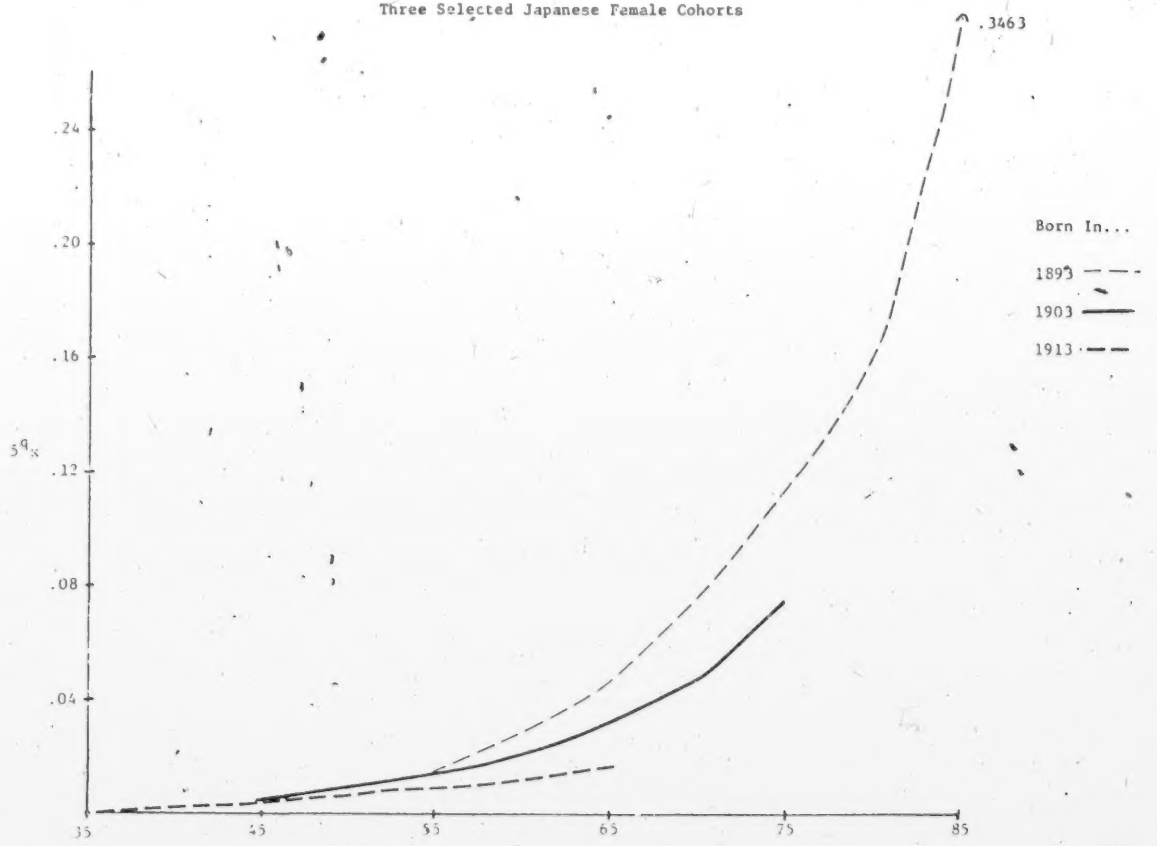


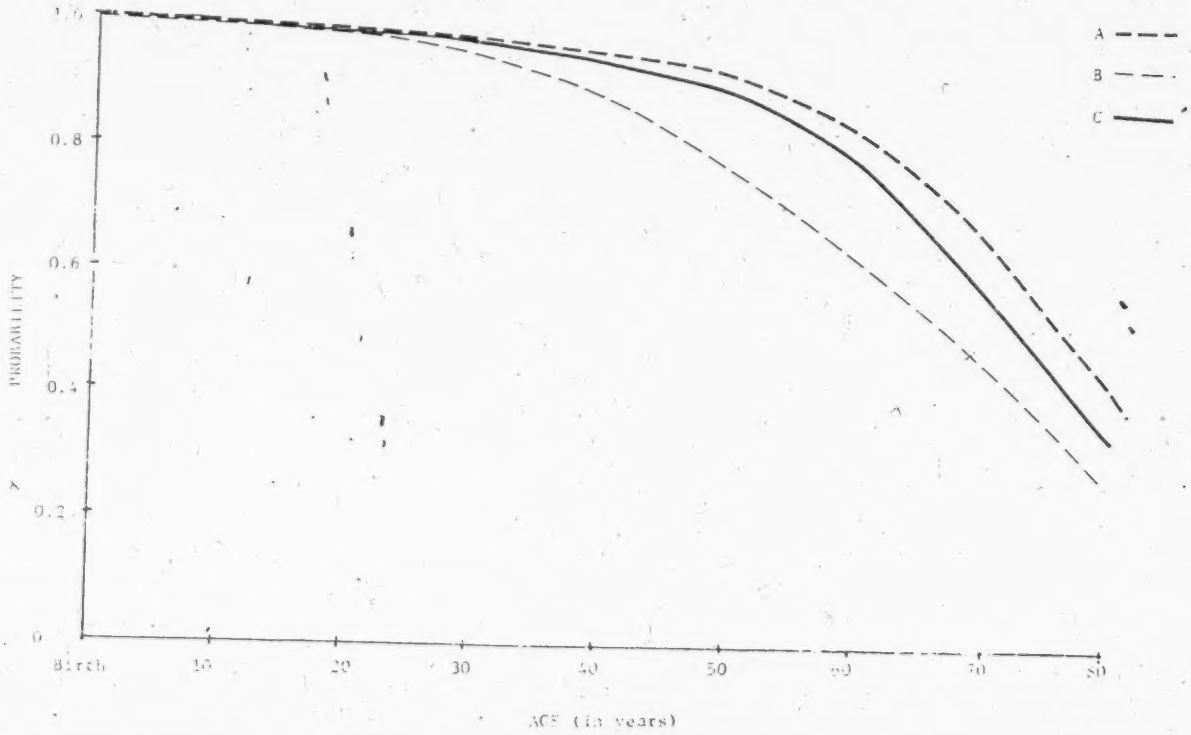
FIGURE 2

Age Specific Survivorship Function Under Three Conditions--

A: Alive (from 1978 U.S. Life Tables)

B: Alive and Free From Heart and Hypertensive Diseases

C: Alive but with Heart and Hypertensive Disease and Disability



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Senator PELL. A couple of questions. What we are concerned with here is not only the extension of life, but the quality of life that is extended, and also not moving up from 73 to 75 to 77, but how can we achieve this idea of really centenarians having a good life?

What is the secret of why some people are vigorous, mentally alert and active in their hundreds, and what is the reason for that, as opposed to those who do not achieve that, in your view, Dr. Soldo?

Dr. SOLDO. Well, first of all, you must appreciate that I am a demographer/gerontologist. So my concern is not so much with individuals. I believe you will hear from two clinicians later in this morning's hearings, as well as from the two women to my left and to my right.

My concern is where the population dynamics are going, and what are the mechanisms that we have available for accomplishing that. In the United States today, we already have some 40,000 centenarians, and their numbers will grow over time.

My particular interest in my research is understanding whether or not we have accomplished life extension at the expense of quality of life. In other words, have all we accomplished is to extend life and extend the period when one is sick and frail and disabled and dependent on others?

The good news is I do not believe that is the case. The major way we seem to be accomplishing mortality reductions is by slowing the rate of disease progress, so that the severity of the disease manifest at any age is substantially less.

I also believe that our ability to slow disease processes will continue in the future, and there is good reason to believe this. Just a few examples: the insulin pump for controlling the rate of flow of insulin for diabetics; medication to control vascular spasm after a stroke.

I do not foresee that we will find a cure or a secret to aging that will make available the fountain of youth to all of our citizens. Rather, our progress will come through sustained biomedical research that controls the rate of disease progression.

It is not as fancy or as attractive or probably merit sufficient press coverage, but it is nonetheless what our data indicate and it is the most reasonable bet for our money for extending life farther into the future.

Senator PELL. These statistics are obviously going to have a profound effect upon Social Security payments and the Social Security budget because if we continue moving this way, Social Security will have to be overhauled every 5 to 10 years to keep up with the increasing population.

Dr. SOLDO. Absolutely. In fact, the projections on which Social Security is based are redone on an annual basis by the actuaries to take into account the significant achievements that we are making.

Senator PELL. In your own research, are you able to conclude that there are nondisease factors that influence longevity, such as the environment and diet?

Dr. SOLDO. Yes. One of the things in that mass of data that I presented you with compares the number of deaths that occur due to cancer versus those that occur through various kinds of cerebral vascular diseases.

What is impressive is that regardless of the stage of development of these developed countries or the cultural context of them, the proportion of deaths due to cancer seems to be fairly stable, whereas the proportion due to the various cerebral vascular diseases jumps around a good bit.

I think that may suggest to us that the cancers, despite the fact that they are a collection of diverse diseases, nonetheless may be more dependent on basic physiology, whereas the cerebral vascular diseases—heart disease, stroke—may be more dependent on environmental factors.

I would look to significant progress being made in controlling—not eliminating, but controlling—the rate of death from the cerebral vascular diseases. I think that is where our greatest opportunities lie.

Senator PELL. Thank you very much, Dr. Soldo. I know you have another commitment. You were very nice to come on such short notice.

Dr. SOLDO. I hope you enjoy the data.

Senator PELL. If there are any further questions from members of the committee, they will be submitted to you.

Dr. SOLDO. Fine. Thank you very much.

Senator PELL. I think in the order of juniority, the youngest being next, we will next come to Miss Ruth Clark. Miss Clark has come down from Rhode Island, and I appreciate very much your coming.

Really, what we are interested in in this hearing is what you believe is the reason for your own active life, an active life that has now reached 97 years and I trust will reach the centenarian mark before too long.

We would just be interested in your thoughts, Miss Clark, and to learn from you, if you would speak as you will.

Miss CLARK. It must help if one's parents and grandparents are long lived. Only my mother did not live to be over 70. However, her mother lived to be over 89 years old and her father lived to be 78. Father died when he was 74. His father lived to be over 75 and his mother 81.

My parents brought the family up on a sensible diet. There were lots of fruit and vegetables. We rarely had hot dogs and very little fried food, and we had regular meals.

After graduating from high school, I started to work in the local bank where my father was cashier. The pay was $5 a week for counting money. I eventually became the bookkeeper and left the bank after nearly 12 years of employment.

None of the great variety of jobs I had after leaving the bank lasted that long. Most of them were interesting. We believe in plenty of laughs and many interests, the first of which for me was music. Singing lessons started at age 15, and at age 16 we went to our first Boston Symphony concert.

When we worked in Providence, we started going to the Rhode Island School of Design at night, first cast drawing and finally life drawing. While working at Brown Brothers & Co. on Wall Street in New York City, we never missed an art show at the National Academy of Art or the watercolor club.

Since retiring, we have not been able to keep up with our interest in art, and the music interest has been limited mostly to radio programs put on by Robert J. Lurtzema of WGBH, 89.7 FM, from 7 in the morning, if we are awake, to 12 noon, and an occasional symphony concert on television.

We subscribe to three magazines, the National and International Wildlife, the Weekly Science News, and the New Republic, which keep us informed on what is going on in the world politically. The Environmental Defense Fund keeps us informed in that area.

The Fortune Society sends quarterly reports; that is a New York City organization. They take in exprisoners and teach them to read and write, a 1-to-1 operation. They have been very successful. Some of the men have gone through college. They help the exprisoners to find jobs.

The War Resistors League is working hard to prevent war. We belong to the local and national American Civil Liberties Union.

At age 67, I bought a Ford coupe and 2 years later, on March 12, 1956, with my new driver's license, drove alone across the United States by the southern route to California. The return trip was driven through the middle of the country, arriving back home on May 23.

At about age 75, the eyesight began to fail and I decided to voluntarily give up my car and my driver's license for the sake of safety for myself and others.

At the age of 80 or 81, I took a short trip alone to England and Spain, and on my return I registered for and took a course in oceanography at the Rhode Island junior college located near my home. Neighbors and relatives provided transportation to this evening course. It was said that I was the oldest student to attend this school. It was a subject in which I have considerable interest.

In my opinion, it is the continuing interest in the variety of subjects noted above that greatly enhances one's life, make living a joy, and tend to smooth over the rough spots in life that everyone must learn to endure.

We even watch with much enthusiasm and have been known to cheer and applaud the success of our local sports teams when they appear on television. Some night games are difficult to watch to completion, but we do love our Boston Red Sox, Bruins, and Celtics.

It may be of interest to the committee to know that I have been actively involved at various times in my life with the Skyscrapers, a Brown University club of amateur astronomers, and Little Rest Bird Club, led by a professor at the University of Rhode Island, for nature hikes and bird census.

During my sixties, with a friend, we hitchhiked through Vermont and adjacent Canada and traveled many nature trails.

May I thank Senator Pell for inviting me to this hearing and call the committee's attention to the fact that a former Rhode Island Senator, Theodore Francis Green, was one of the oldest Senators to serve. Perhaps our wonderful climate in Rhode Island is a major contributor to longevity.

We thank you.

[The prepared statement of Miss Clark follows:]

LONGEVITY

IT MUST HELP IF ONE'S PARENTS AND GRANPARENTS ARE LONG LIVED ONLY MY MOTHER DIDN'T LIVE TO BE OVER 70. HOWEVER, HER MOTHER LIVED TO BE OVER 89 YEARS OLD AND HER FATHER LIVED TO BE 78.

FATHER DIED WHEN HE WAS 74. HIS FATHER LIVED TO BE OVER 75 AND HIS MOTHER 81.

MY PARENTS BROUGHT THE FAMILY UP ON A SENSIBLE DIET. THERE WERE LOTS OF FRUIT AND VEGETABLES. WE RARELY HAD HOT DOGS AND VERY LITTLE FRIED FOOD. AND WE HAD REGULAR MEALS.

AFTER GRADUATING FROM HIGH SCHOOL, I STARTED TO WORK IN THE LOCAL BANK WHERE MY FATHER WAS CASHIER. THE PAY WAS $5.00 A WEEK FOR COUNTING MONEY. I EVENTUALLY BECAME THE BOOKKEEPER AND LEFT THE BANK AFTER NEARLY TWELVE YEARS OF EMPLOYMENT.

NONE OF THE GREAT VARIETY OF JOBS I HAD AFTER LEAVING THE BANK LASTED THAT LONG. MOST OF THEM WERE INTERESTING.

WE BELIEVE IN PLENTY OF LAUGHS AND MANY INTEREST THE FIRST OF WHICH FOR ME WAS MUSIC. SINGING LESSONS STARTED AT AGE 15 AND AT AGE 16 WENT TO OUR FIRST BOSTON SYMPHONY CONCERT.

WHEN WE WORKED IN PROVIDENCE, WE STARTED GOING TO THE RHODE ISLAND SCHOOL OF DESIGN AT NIGHT. FIRST CAST DRAWING AND FINALLY

LIFE DRAWING. WHILE WORKING AT BROWN BROS.' & CO. ON WALL STREET IN NEW YORK, WE NEVER MISSED AN ART SHOW AT THE NATIONAL ACADEMY OF ART OR THE WATERCOLOR CLUB.

SINCE RETIRING, WE HAVE NOT BEEN ABLE TO KEEP UP WITH OUR INTEREST IN ART AND THE MUSIC INTEREST HAS BEEN LIMITED MOSTLY TO RADIO PROGRAMS PUT ON BY ROBERT J. LURTZEMA OF WGBH, 89.7 F.M. FROM 7 AM (IF WE ARE AWAKE) TO 12 NOON AND AN OCCASIONAL SYMPHONY CONCERT ON TELEVISION.

WE SUBSCRIBE TO THREE MAGAZINES - 'THE NATIONAL AND INTERNATIONAL WILDLIFE,' 'THE WEEKLY SCIENCE NEWS' AND 'THE NEW REPUBLIC' WHICH KEEPS US INFORMED ON WHAT IS GOING ON IN THE WORLD POLITICALLY.

THE ENVIRONMENTAL DEFENSE FUND KEEPS US INFORMED IN THAT AREA.

THE FORTUNE SOCIETY SENDS QUARTERLY REPORTS. THEY TAKE IN EX-PRISONERS AND TEACH THEM TO READ AND WRITE - A ONE TO ONE OPERATION. THEY HAVE BEEN VERY SUCCESSFUL. SOME OF THE MEN HAVE GONE THRU COLLEGE. THEY HELP THE EX-PRISONERS TO FIND JOBS.

THE 'WAR RESISTERS LEAGUE' IS WORKING HARD TO PREVENT WAR.

WE BELONG TO THE LOCAL AND NATIONAL AMERICAN CIVIL LIBERTIES UNION.

AT AGE 67 I BOUGHT A FORD COUPE AND TWO YEARS LATER ON MARCH 12, 1956 - WITH MY NEW DRIVERS LICENSE - DROVE ALONE ACROSS THE UNITED STATES BY THE SOUTHERN ROUTE TO CALIFORNIA. THE RETURN TRIP WAS DRIVEN THROUGH THE MIDDLE OF THE COUNTRY ARRIVING BACK HOME ON MAY 23rd. AT ABOUT AGE 75 THE EYE SIGHT BEGAN TO FAIL AND I DECIDED TO VOLUNTARILY GIVE UP MY CAR, MY DRIVERS LICENSE FOR THE SAKE OF SAFETY FOR MYSELF AND OTHERS.

AT THE AGE OF 80 OR 81 I TOOK A SHORT TRIP ALONE TO ENGLAND AND SPAIN AND ON MY RETURN I REGISTERED FOR AND TOOK A COURSE IN OCEANOGRAPHY AT THE RHODE ISLAND JUNIOR COLLEGE LOCATED NEAR MY HOME. NEIGHBORS AND RELATIVES SUPPLIED TRANSPORTATION TO THIS EVENING COURSE. IT WAS SAID THAT I WAS THE OLDEST STUDENT TO ATTEND THIS SCHOOL - IT WAS A SUBJECT IN WHICH I HAVE CONSIDERABLE INTEREST.

IN MY OPINION, IT IS THE CONTINUING INTEREST IN THE VARIETY OF SUBJECTS NOTED ABOVE THAT GREATLY ENHANCE ONE'S LIFE, MAKE LIVING A JOY AND TEND TO SMOOTH OVER THE ROUGH SPOTS IN LIFE THAT EVERYONE MUST LEARN TO ENDURE.

WE EVEN WATCH WITH MUCH ENTHUSIASM AND HAVE BEEN KNOWN TO

CHEER AND APPLAUD THE SUCCESS OF OUR LOCAL SPORTS TEAMS WHEN THEY APPEAR ON TELEVISION. SOME NIGHT GAMES ARE DIFFICULT TO WATCH TO COMPLETION, BUT WE DO LOVE OUR BOSTON RED-SOX, BRUINS AND CELTICS.

IT MAY BE OF INTEREST TO THE COMMITTEE TO KNOW THAT I HAVE BEEN ACTIVELY INVOLVED AT VARIOUS TIMES IN MY LIFE WITH:

1. "THE SKYSCRAPERS" - A BROWN UNIVERSITY CLUB OF AMATURE ASTRONOMERS.

2. "LITTLE REST" BIRD CLUB - LED BY A PROFESSOR AT THE UNIVERSITY OF RHODE ISLAND FOR NATURE HIKES AND BIRD CENSUS.

DURING MY 60'S, WITH A FRIEND, WE HITCH-HIKED THRU VERMONT AND ADJACENT CANADA AND TRAVELLED MANY NATURE TRAILS.

MAY I THANK SENATOR PELL FOR INVITING ME TO THIS HEARING AND CALL THE COMMITTEE"S ATTENTION TO THE FACT THAT A FORMER RHODE ISLAND SENATOR - THEODORE FRANCIS GREEN - WAS ONE OF THE OLDEST SENATORS TO SERVE. PERHAPS OUR WONDERFUL CLIMATE IN RHODE ISLAND IS A MAJOR CONTRIBUTOR TO LONGEVITY!

RUTH M. CLARK
BORN AUGUST 27, 1887
(MISS CLARK EDITORIALIZES ON OCCASION
USING "WE," "OUR," AND "US" FOR EMPHASIS)

Senator PELL. Thank you very, very much for a well-thought-out and very interesting and fascinating statement there. As you point out, Theodore Green was over 90 when he was still serving in the Senate, if my recollection is correct, and I think was the first nonogenarian to be serving in the Senate. And I hope in my lifetime we may live to see this repeated and repeated. [Laughter.]

Senator PELL. Now, I think we would like to hear from Mrs. Tucker, who is the oldest lady who is with us today, and then go to questions to you both. Mrs. Tucker is a lifelong resident of the District of Columbia. She has been involved in many activities in her life and she is 103, so she has a 6-year edge on Miss Clark.

She was active in the founding and organizing of the International Brotherhood of Sleeping Car Porters, and I really thank you for coming here. Just hold the mike quite close to you because it is hard to hear sometimes.

Mrs. TUCKER. Thank you so much. I am very happy that you have invited me to be with you today. My name is Rosina Corrothers Tucker. I was born here in Washington, DC, on November 4, 1881.

My father was a shoemaker. I have watched him many days fashion the shoes, wax the threads, turn the shoes inside out, and sew them by hand. He also repaired shoes for cripples. Now, how he learned and when he learned to read or write, I do not know because he was a slave boy. But somehow or other, he learned to read and to write.

When we were 6 years old, each child was taught to write and at least the second or third table in arithmetic, and when we were 6 years old he taught us how to play the organ and the piano. Where he learned, I do not know, but we furnished music; the five of us out of the family of nine who lived to manhood and to womanhood were all musicians.

I remember at 12 years old, I played for Sunday school, and I played for many of the big churches here in the city. My oldest sister also was a great musician. My father had my older brother taught the violin and he taught the rest of us the violin.

After a while, we had all sorts of instruments in the house. We had a great big base horn and the girls would try to fill that; I think I was able to bring out one toot once in a while.

We went to school in the neighborhood. The schools were segregated, of course, but the streetcars, public buildings and such were not. We had a good family home, Christians, and to this day I never attempt anything without prayer, and it has been one of the greatest things in my life, my faith in God.

Now, when the NAACP, the National Association for the Advancement of Colored People, was organized, I became interested in that. I knew White, who was executive secretary. I knew DuBois and worked with him.

At our church, we had what was known as a lyceum, and at that place, as children, we heard some of the great statesmen of this city speak. I cannot call the names right now, but I heard Langston and other people who were Congressmen in this city.

Now, when I married, I married a minister and he was a writer, and he died shortly. And I came back to Washington and became, as I say, interested in the NAACP. Then I became interested in

community work, such as civic work, and because of that I was asked to join the Federation of Civic Associations.

I have worked with civil defense. I do not know how many awards I have; I do not know where to put them all. But I have addressed many organizations. I was asked by one person, did you think when you were a little girl that you would be on TV? I thought it was one of the crazy questions because when I was a little girl, we did not have TV. [Laughter.]

We did not have gas; we did not have water in the house. There are so many things we did not have, so naturally I did not aspire to that. But I am proud to say that I have appeared on almost all of the stations here in Washington who have paid my expenses to New York for broadcast nationwide.

As I said, I cannot recall all of the awards I have gotten. I think that you are somewhat interested in my work with organized labor. Mr. Tucker was a pullman porter, and because of that I became interested when the union of porters was suggested.

I do not know how I got tied up in that, even. It just seems that I just am in something. But I worked with A. Philip Randolph in organizing the Brotherhood of Sleeping Car Porters. I was on the speakers' list for it, and along with them I suffered with them.

I do not know whether I have covered just what you would like to hear, but in this Brotherhood of Sleeping Car Porters it attracted so much attention after years of struggle and we received our contract. It was remarkable, the attitude Mr. Randolph took concerning it.

He seemed to forgive all of those who worked against him and he just said that they were willing and ready to go on, and I want to just read his words. He said, without pomp; pride without pomp. And I think in that there is a lesson for all of us.

So many times when we accomplish something, we are filled with pride. But if we are truly working for the good of mankind, we have pride, but we have pride without pomp.

I have been asked many questions about myself. I have spoken at places and they have said—one person asked me, what did you have for breakfast this morning, which meant did I eat special food, you know. Many, many questions have been asked me and I have been involved in so many things.

And if you will bear with me, let me read a portion of the book that I wrote, "My Life as I Have Lived It."

Having dealt with various groups of people, unpleasant occurrences have ensued what at the moment caused me some concern. But on reflection, I accepted such as challenges and used what ability I had to surmount them rather than allow them to depress me, for I have grown to the degree that I have no fear of adverse opinions.

Trying to agree with everyone, I would find myself going around in circles. So instead of circling, trying to please many, I am still using my experience, serving the best I can where I am needed in spite of adverse opinions.

Apprised of my age, a young man asked me, what was it like in your day? In my day? I repeated, this is my day; today is my day, as it is your day. Although I live far removed from the time I was born, I do not feel that my heart should dwell in the past. It is in the future. Each day for over a century added to another has culminated in growth that has led to my present experience and has made me the person I am today and will be tomorrow.

I have found myself working with individuals who had attended schools of higher education, whose posture was that of superiority to all around them, magnified by their exalting themselves by denigrating others not so fortunate. On the other hand,

I have worked with those who took pride in their ignorance, designating scholars "educated fools."

However, I have the blessing to have known and worked with intellectuals and the unlettered who were delightful, compassionate, unassuming and gracious, whose hearts vibrated with serene rhythm with my heart and the hearts of all who knew them.

I am frequently asked what I attribute my long life to. My reply is that I had not thought too much of age until my sister Marietta reached the age of 75 and exclaimed, "just to think I am three-quarters of a century old."

It was then I wondered if I would reach that age. However, my reply to the question is that I have no answer, only to say that my life is in God's hands and His purpose for me, also, and I shall live until his purpose is fulfilled. Therefore, I must pursue that purpose. I have not spared myself in the interest of my home, my church, and my community, or with individuals and groups of various professions and occupations, and I shall continue to do so, for, remembering the past, faith directs me to welcome the future.

As I survey the spring, the summer, the fall and the winter of my lifespan, with its illness and health, poverty and wealth, envy and goodwill, triumphs and defeats, and life and death, I can but conclude that these incidents form the weave and woof of the texture of the fabric of my being, challenging me and urging me to my ultimate emotional and spiritual fulfillment.

[The prepared statement of Mrs. Tucker follows:]

SENATE LABOR AND HUMAN RESOURCES COMMITTEE

SUBCOMMITTEE ON AGING

Thursday, September 27, 1984

Statement of Mrs. Rosina Budd Harvey Corrothers-Tucker

I have had a very full life. Things are very different now then they were when I was young. I was born in Northwest Washington. I am the last of my generation. I was the middle of nine children. We all went to schools in the district. We used to walk to school every day. It was very close to home. We hardly ever used the street cars. We walked long distances almost everywhere we went.

The country was in fairly good shape. Of course there was segregation, however, I hardly noticed any racism for we lived in a mixed neighborhood. The people were very friendly. They helped one and other whenever it was needed. Public buildings and street cars were not segregated but places like the theater were. That didn't bother us too much because we were not a theater going family.

The church was very important. It was a great influence on everybody's life. Although people weren't perfect, as I recall, they all lived according to the Bible. No drinking, no dancing or smoking. Dancing was considered a bad thing and even a man who smoked was considered out of line. Sex wasn't even thought of never mind talked about. If it was, it was done so in hush tones. My have things changed!

I was married when I was seventeen years old to my first husband, James D. Corrothers. We were married for 18 years during which we had a son. I was married to my second husband, Berthea Tucker, for 42 years. Mr. Tucker was a porter for the Pullman Company and it was because of him that I became involved in the the International Brotherhood of Sleeping Car Porters.

Reflecting on my marriage to Mr. Tucker:

I believe that God has something for all of us to do and ultimately places us where He wants us to be to carry out His purposes. I have never felt that my life was my own inasmuch as throughout my life, I found myself being placed here and there. But, I am prone to think that together with all my former experiences, becoming Mrs. Tucker caused me to reach my highest efforts.

The efforts I refer to were my involvement in the founding and organizing of the International Brotherhood of Sleeping Car Porters and also in assisting A. Philip Randolph in developing the first march on Washington on behalf of all American blacks. I felt like a pioneer. I don't have any special tips on how to live a long life. Most of my family lived til their mid to late 80's. However, my great grandmother lived to be 101, my dad died in his 50's, and my grandparents lived until they were in their middle 90's. I don't know why we live so long. We didn't do anything special. We were poor but not really poor. We had decent clothes and enough food to eat. We believed in God, that was important. My life has been virtually set out for me. I have done many things that I have never dreamt of doing. Nothing bad,of course. Things just seemed to happen. I speak to many groups about my life and I remember a student in a history class asked me who I wish I could have been like? I told him I never dreamed of being anyone but myself. I think that is important. A person should be themselves. I'm not a sickly person. I've had regular childhood diseases. I do see a doctor regularly now, once a month. I do not have a regular exercise routine but I take care of my house and make the beds, do the laundry and cook. That's excercise!

I have written a book entitled, My Life As I Have Lived It, I am involved in many church and civic activities. I have been honored by awards from many organizations including the NAACP and the International Brotherhood of Sleeping Car Porters.

(The Senators may be interested to know the things that I have been currently involved in such as the historical society. Maybe invite them to listen.)

I want to take the time to thank Senator Pell and his staff and the District's Department of Human Services for inviting me here today.

NOMINATION FORM FOR GOLDEN AWARD

NAME OF NOMINEE Mrs. Rosina Budd Harvey Corrothers-Tucker AGE Born 11/4/1881 101½ years

ADDRESS 1128 7Th Street, N.E.
Washington, D. C.

TELEPHONE NO. 546 9226

CLUB, ORGANIZATION, OR SENIOR CENTER AFFILIATION
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ACTIVITIES INVOLVED IN

PLEASE DESCRIBE IN 100 WORDS OR LESS WHY THE ABOVE MENTIONED CITIZEN IS BEING NOMINATED TO RECEIVE THE GOLDEN AWARD.

Mrs. Tucker is a giant among women - pioneer and present. Her vast accomplishments expand three-quarters of a century, with a major highlight her able assistance, at the personal request of A. Philip Randolph, in organizing the International Auxiliary to the International Brotherhood of Sleeping Car Porters and about whom it was written, "it was really the women who were instrumental in assisting the financing and organization of the Brotherhood".

In 1941, she worked closely with A. Philip Randolph in developing the 1st march on Washington, D. C. on behalf of union and non-union blacks -- a march called off only when then President Franklin D. Roosevelt pledged to issue Executive Order 8802 which banned discrimination in industries holding government contracts, and out of which a Commission on Fair Employment Practices was established, leading to legislation which opened many Federal jobs to black people for the first time.

Her many awards include: a silver cup from the NAACP, a certificate of appreciation from her church, a scroll of honor from the INternational Brotherhood of Sleeping Car Reporters, and she was chosen by the Department of Labor as the representative of labor on their mural commemorating "75 years of Progress of the American Black Women" at the Chicago Exposition [1940].

Mrs. Tucker is a narrator of the Columbia Historical Society [in conjunction with the Snithsohian Institution] "A Servant and a Man-The Story of the Pullman Porter". She has written a book entitled, "My Life As I Have Lived it".

FROM: The CONGRESSIONAL RECORD: Washington, Wednesday, October 28, 1981.
District of Columbia Commission For Women
NAME OF SUBMITTER Mrs. Alice T. Davis, Chair TELEPHONE NO. 332-5236
332-1643
Mrs. Ethel Williams, Ex. Dir. - The District Building

THIS COMPLETED FORM MUST BE SUBMITTED TO THE D. C. OFFICE ON AGING NO LATER THAN MAY 13, 1983. PLEASE MAIL TO:

Senior Citizens Program Committee
D. C. Office on Aging
* 1012 14th Street, N. W., Rm. 1106
Washington, D. C. 20005

Attention: Ms. Nancy Raley

* After May 6, 1983 the new mailing address will be: 1424 K Street, N. W., 2nd Floor

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House of Representatives

THE 100TH BIRTHDAY SALUTE TO ROSINA BUDD HARVEY CORROTHERS-TUCKER

HON. WALTER E. FAUNTROY

OF THE DISTRICT OF COLUMBIA

IN THE HOUSE OF REPRESENTATIVES

Wednesday, October 28, 1981

Mr. FAUNTROY. Mr. Speaker, on November 4, 1981, Rosina Budd Harvey Corrothers-Tucker, a life-long resident of the District of Columbia, will celebrate her 100th birthday. It gives me great pride to honor Mrs. Tucker on such an occasion and to share with my distinguished colleagues the remarkable life that this fine lady has had, as well as her contributions not only to the District of Columbia but throughout this great country of ours.

Rosina Budd Harvey was born in Washington, D.C., on November 4, 1881, to Lee Roy and Henrietta Harvey, both of whom were slave children from King and Queen Counties, Va. Her childhood is filled with the history of Washington, and she vividly recounts many afternoons spent listening to John Phillip Sousa conducting the Marine Band on both the Capitol and Monument Grounds; Sunday school picnics in "rural" Bladensburg, Md.; and the Italian organ grinder, who, with his monkey, played for pennies, seemingly on every corner of Washington.

She attended the M Street High School—known today as Dunbar High School—and recalls that the student population came not only from all over the city but from Maryland, Alexandria, Arlington, and Hall's Hill, Va. Some of the students from Virginia took a ferry boat from Alexandria to the wharf in Southwest and would walk from there to the M Street School.

In 1898, when Rosina Harvey was 17, she met and married James D. Corrothers, a writer and orator. Together they would travel, visiting churches and schools throughout New York and New Jersey, where he would speak to groups while she played the piano. After 15 years of marriage, during which a son was born, Mr. Corrothers died and Rosina Harvey Corrothers returned to Washington and lived once again in the home of her mother and father.

During this time, Rosina Corrothers helped found the Northeast Women's Club, which in her words was "organized to do something constructive—not just another incipient card club." Some of the club's projects included collecting adequate clothing for area children who were poor; collecting money to buy safety patrol boys raincoats and caps; and successfully getting local authorities to install lighting and traffic signals at dangerous intersections.

In 1919, Rosina Harvey Carrothers married Berthes Tucker, who worked as a porter for the Pullman Co. Reflecting on her marriage to Mr. Tucker, Mrs. Tucker recently stated:

> I believe that God has something for all of us to do and ultimately places us where He wants us to be to carry out his purposes. I have never felt that my life was my own inasmuch as throughout my life, I found myself being placed here and there. But, I am prone to think that, together with all my former experiences, becoming Mrs. Tucker caused me to reach my highest efforts.

The efforts to which Mrs. Tucker refers were an integral part of the founding and organization of the International Brotherhood of Sleeping Car Porters, the first black union in the country.

A. Philip Randolph, the first international president of the brotherhood, aware of Mrs. Tucker's civic work and organizing abilities, personally spoke to her concerning the necessity of forming an international ladies auxiliary to the brotherhood, a task for which he requested her assistance and to which she readily agreed. As she now explains it:

> The Ladies Auxiliary was absolutely necessary in order that porters' wives be cognizant of their husbands' working conditions, for in the event of a strike, the wife must understand why her husband is striking and support him. It was really the women who were instrumental in assisting the financing and organization of the Brotherhood.

As the first international secretary-treasurer of the ladies auxiliary, Mrs. Tucker traveled all over this country and parts of Canada, explaining the role and importance of porters' wives in the organizational efforts of the brotherhood.

During this time, however, Mrs. Tucker never lost sight of her church, civic, and community work and was elected the first president of the Public Interest Civic Association in the District of Columbia, which, under her leadership, joined and became one of the strongest associations in the Federation of Civic Associations—a coalition of black civic associations still in existence.

In 1941, Mrs. Tucker worked closely with A. Philip Randolph in developing the first march on Washington on behalf of all American blacks—not just union members. However, when President Roosevelt heard of the planned march, he requested that Mr. Randolph call it off. Randolph agreed only when President Roosevelt pledged to issue Executive Order 8802 which banned discrimination in industries holding Government contracts. As a result of this order, a Commission on Fair Employment Practices was established, leading to legislation which opened many Federal jobs to black people for the first time in history.

It was through such efforts that Mrs. Rosina Harvey Corrothers-Tucker played a vital and tireless role in the evolution of this country and her community. She is not surprisingly the recipient of many awards, including, among others, a silver cup from the NAACP for outstanding service; a certification of appreciation and membership in recognition from her church, the 15th Street Presbyterian Church, a scroll of honor from the International Brotherhood of Sleeping Car Porters; and she was chosen by the Department of Labor as the representative of labor on their mural commemorating "75 Years of Progress of the American Black Women" at the 1940 Chicago Exposition. She has written a book entitled, "My Life as I Have Lived It," a history of Washington, the black labor movement, and the civil rights movement. She is also the narrator of a not yet released documentary produced by the Columbia Historical Society in cooperation with the Smithsonian Institution, entitled, "A Servant and a Man—The Story of the Pullman Porter."

Mr. Speaker, as the congressional Representative from Mrs. Tucker's home district of Washington, D.C. I am extremely proud of Mrs. Tucker and invite my colleagues to join me in saluting Rosina Harvey Corrothers-Tucker, on her 100th birthday, for her many years of courage, conviction, strenth, and dedication to the causes of America's black men and women which have elevated the quality of life for us all.

Senator PELL. Thank you very much, Mrs. Tucker, for your testimony.

I see we are greatly honored that the President pro tem of the Senate, who is also on the majority party of this committee, is with us, Senator Thurmond, and I think he should be presiding at this point.

Senator THURMOND. No, not at all. You go right ahead.

Thank you very much, Mr. Chairman. I am very pleased to be here and I want to congratulate you ladies for coming and testifying. I am convinced that a lot of statements you made are right down the line; they are right on the point.

From my experience, I have found that people should not talk so much about age as they should physical and mental fitness. After all, that is what counts. I have seen people in their forties and fifties that were not mentally or physically fit, or both, and I have seen others in their eighties and nineties that are physically and mentally fit.

Adenauer was President of Germany at 88, and many other musicians and famous people of the past in so-called old age have made great successes. In my opinion, reasonable exercise and proper nutrition and the proper outlook on life are very important to living to old age and being happy.

I have always gone on the theory to do the best I could and leave the rest to the Lord; there is no use to worry over anything. We have got to learn to accept the inevitable, and if we do it in the right tone, it affects our whole system.

So, in my judgment, I think your testimony here is going to be very helpful to us, and we thank you very much.

Senator PELL. Thank you very, very much, Senator Thurmond.

Senator Chafee?

Senator CHAFEE. Well, thank you very much, Senator Pell. As you know, I am not a member of this committee, but I was anxious to come by to listen to the testimony, and particularly that of Miss Clark, whom my wife and I have known, I think, for about 30 years.

I certainly was impressed, Mr. Chairman, by the testimony, and I thought what Miss Clark said, and indeed Mrs. Tucker—they both seemed to lay stress on the fact, as Miss Clark said in her testimony—"It is the continuing interest in the variety of subjects that greatly enhances one life." Mrs. Tucker has the same theme. Each day is a new day, and live that day.

I think it is wonderful, and I commend you, Mr. Chairman, for conducting these hearings. Regretfully, I cannot stay, but I did want to drop by in this little interim. Thank you.

Senator PELL. I would add to my colleagues that a great debt is owed to Senator Grassley because it is his hearing. He would be presiding here, and it is with his permission that we are going ahead with the hearing. Thank you very much indeed.

Senator THURMOND. Thank you very much.

Senator PELL. Thank you very much.

Now, I would like to come to some questions, if I could, with you both as to what—I guess I am trying to think through properly because in some ways in your testimony you have answered many of the questions that I had in mind.

But starting out for the moment with Miss Clark, if you were asked to digest the secret of your longevity, would it be, as you said, retaining an interest in outside subjects, or would be, as my predecessor, Theodore Green, said when I asked him for his secret? He said it was a question of moderation in all things.

Which do you think is more important, or do you think that Theodore Green was correct?

Miss CLARK. I am not sure that I got all your question. Are you repeating the first question you gave me, typed, about the important changes in society?

Senator PELL. No, no. I was asking you a separate question which was not on those I gave you.

Miss CLARK. I will ask Ted, my nephew, what you said.

Senator PELL. I said, is moderation an important factor in your longevity?

Miss CLARK. Yes. You cannot go to extremes. You have to be very moderate in your living, I think; live a regular life. I go to bed quite early. I need plenty of sleep, but I have lots of interests, and I think that is the major thing that keeps me going is all my interests.

Senator PELL. In your own opinion, what are the most important changes you have seen in our society during your lifetime?

Miss CLARK. Improved housing and transportation for the elderly; that is, automobiles, buses, better food, medicine, better medical care and improvement. I think of inventions. Now, we have telephones. When I was 16, we had our first telephone.

People at our house have buses that come and get them to take them to activities. I think things like that are very important.

Senator PELL. During your own lifetime—in fact, for most of your lifetime, there was no Social Security. Do you believe that Social Security has had a very real effect upon the lifestyle of senior citizens?

Miss CLARK. Yes, I have seen many examples of the type of help where I live. They are able to get out and be active more than they used to be. Of course, some of them have their own cars, but they are able to go. If there are some special activities, a bus comes and picks them up, and I think that that is very important to keep active, physically active.

Senator PELL. You certainly have led a very active life, and I gather you believe that the variety of activities in your life has contributed to your health. Would that be correct?

Miss CLARK. As far as my own active life, my activity is mostly mental. I cannot be too active physically, but mentally I am very active, and I think the variety of activities that I have is essential. My mental outlook is enhanced with outside interests, and modern communications help develop and maintain them.

Variety, I think, is the spice of life, as they say, and I think that that is important that we have a variety of interests.

Senator PELL. What advice would you have to our subcommittee and to the Congress as to how we can improve the health and the vigor and the lifestyles of our older citizens?

Miss CLARK. Well, I think your committee should maintain Social Security and medicare for my generation and succeeding genera-

tions; help the younger generation to develop a variety of interests to enhance their life, and a desire for longevity.

Young people are our future; take care of them.

Senator PELL. Thank you. Now, one further question which I think all of us who are with you here wondered about, and that is your physical way of life. Could you describe to us a typical day? How long do you sleep? What do you eat? Do you eat two meals?

Miss CLARK. Are you talking about diseases?

Senator PELL. No. I am talking about your way of life, a typical day. How long do you sleep?

Miss CLARK. If I am alive and kicking by 11, I am lucky. [Laughter.]

But after that, I am kicking.

Senator PELL. Do you eat two meals a day or three meals a day?

Miss CLARK. Three, and regular.

Senator PELL. Good.

Miss CLARK. And I get Meals on Wheels, which is a big asset, 3 days a week because the meal is so big that Monday, I get a meal and I eat half of it and Tuesday the other half. Wednesday, I get another meal and eat half of it Wednesday and eat the other half Thursday; Friday, the same. Then, Sunday, I get frozen dinners. Once in a while, I get invited out. Hooray. [Laughter.]

Senator PELL. Going back to sleep, how many hours a day do you sleep?

Miss CLARK. How long do I sleep?

Senator PELL. How many hours a day?

Miss CLARK. Oh, I sleep at least 10 hours.

Senator PELL. Good.

Miss CLARK. At least 10 hours, and then sometimes I have a nap in the afternoon, an hour; sometimes longer, but usually an hour.

Senator PELL. Well, I really thank you for coming down here. I am very glad you are here. Now, I would like, if you would sit tight, to ask some questions, if I could, to Mrs. Tucker and get a little bit of the secret to her longevity.

First, though, what do you think has caused the value changes in American society that you mentioned during your testimony.

Mrs. TUCKER. I am sorry. I do not hear you well.

Senator PELL. Oh, fine.

Mrs. TUCKER. If you would speak a little slower?

Senator PELL. Sure. What has caused the changes in values in American society that you have mentioned in your testimony?

Mrs. TUCKER. Yes, there are many changes in our society today. I think when we came along, we were satisfied with simple things. Now, we are not satisfied unless we have big things.

I remember if you asked a kid to go to the store for you, you gave him a penny and he thought that was great. But, now, to do the same job, you would hardly offer him a quarter. There are children who have things today one after another. For instance, I have heard parents say, my child has so-and-so and so-and-so; there is nothing else for him to have.

And I think a great deal of the restlessness comes from the fact that our children are brought up feeling that they must have things without the responsibility of earning them. And then I think to a great extent that parents are responsible for such things be-

cause they do not insist that their children work to earn what they get.

Our young people do not have the motivation that they had then.

Senator PELL. Thank you. Now, I would like to talk on more the physical side of life. How many hours a day do you sleep? How many meals a day do you eat? Do you eat everything or do you skip meat and eggs?

Mrs. TUCKER. I do not want to advertise this, but I live alone.

Senator PELL. Right.

Mrs. TUCKER. I do most of my housework. I have friends who come in sometimes and, you know, do little things.

Senator PELL. Right.

Mrs. TUCKER. But I take care of myself.

Senator PELL. But how many hours a day do you sleep?

Mrs. TUCKER. Sleep?

Senator PELL. Sleep, yes.

Mrs. TUCKER. Sometimes I will fall asleep, but I do not make a practice of sleeping during the day. There is always something I can do. I have many engagements and I have to prepare for them. I have to leave the city sometimes. I have been as far as Hollywood, FL, to speak, and there is preparation for such as that.

Together with taking care of the home and taking care of myself, it about fills up my time.

Senator PELL. My question is, do you sleep 8 hours a day, 6 hours a day, 10 hours a day, 12 hours a day?

Mrs. TUCKER. Oh, no. I get about 6, 7 hours' sleep.

Senator PELL. And do you eat two meals a day or three meals a day?

Mrs. TUCKER. Two meals a day.

Senator PELL. And do you eat everything, meat and eggs?

Mrs. TUCKER. I eat anything I want. [Laughter.]

Senator PELL. But among the things you want, does that include meat and eggs?

Mrs. TUCKER. Meat and eggs?

Senator PELL. Yes.

Mrs. TUCKER. Oh, yes; fruits, vegetables, very little fried food, and so on.

Senator PELL. I thank you.

Mrs. TUCKER. So far as saying I do not want this, do not want that, or do not eat the other, I do not say that.

Senator PELL. Well, I thank both Mrs. Tucker and Miss Clark for coming down. I particularly thank Miss Clark for coming down from my State of Rhode Island, and Mrs. Tucker. We welcome you here. Thank you for coming very, very much indeed. I hope that out of this hearing and whatever wisdom we acquire from it, we can increase not only the longevity of our citizens, but the quality of life of that longevity.

So I thank you both and congratulate you on the sharpness of your testimony. Thank you very much.

Now, we will move on to the next panel, and that will be Dr. Sidney Katz, Dr. John Collins Harvey, and Dr. Allan Goldstein. I guess we will go in reverse alphabetical order as it is here, and start out with Dr. Sidney Katz, of the Brown University Long-Term Care Gerontology Center in Providence.

Dr. Katz?

STATEMENT OF SIDNEY KATZ, BROWN UNIVERSITY LONG-TERM CARE GERONTOLOGY CENTER, PROVIDENCE, RI; JOHN COLLINS HARVEY, PROFESSOR OF MEDICINE AND GERIATRICIAN, GEORGETOWN UNIVERSITY, WASHINGTON, DC; AND ALLAN L. GOLDSTEIN, CHAIRMAN, DEPARTMENT OF BIOCHEMISTRY, GEORGE WASHINGTON UNIVERSITY SCHOOL OF MEDICINE, WASHINGTON, DC

Dr. KATZ. First——

Senator PELL. Excuse me. I hope that your statements could be limited to 5 or 10 minutes. The full statements will be inserted in the record, and that will give us a chance for a couple of questions.

Dr. KATZ. First, Senator Pell, I want to thank you and the members of your committee and staff for arranging this. I see it as a turning point. Some of the remarks I will make in other words were more eloquently said by the previous panel—and that in itself is important to recognize—what role those words have in future directions.

I am an associate dean of medicine at Brown University and director of the Gerontology Center, and chose to work some 30 or 35 years ago on issues of the aged. I chose to work in the field of function or fitness or wellness, which was not a popular thing in those days. We did not teach those things, and we did not study those things.

Since World War II, the U.S. public has been increasingly concerned with issues of service cost and care. Our policies have supported the view that health care is a right and that quality must not be sacrificed. At the same time, expenditures for services have increased rapidly, especially the proportion of government expenditures.

Highlighting the problem, Judith and Lester Lave of the Carnegie Institute have argued persuasively that issues of cost cannot be separated from issues of quality. This reflects an important implication for today's hearing—the relationship between quality and cost.

It is clear today that the "graying of America" magnifies these concerns. We live in a society where people live beyond the age of vigorous health. We live in a society where 1 out of every 20 people is over age 75. By 2040, when the baby boom generation is elderly, almost 1 out of 10 will be over the age of 75.

We live in a society where medical technology prolongs the lives of individuals who would have died otherwise from chronic illness, impairments, or debilitating accidents. Especially, we live in a society where many elderly cannot independently manage certain simple but necessary functions, such as shopping, dressing, and bathing; 4 out of 10 over the age of 85 need such assistance; 2 out of 10 of those in the age group of 75 to 84.

We live in a society, unfortunately, where too few are prepared to help the elderly live independently in the community. We live in a society where nursing home expenditures double every 5 years, where medicare cannot keep up with the cost of services, and

where chronic conditions are the No. 1 problems in care, in terms of both number and cost.

In my work, I often discuss with groups of elderly people their needs and wishes. Uniformly, they say that they wish to live as independently as possible for as long as possible. They want to avoid being institutionalized. The first words they use are not that they want to live forever. Most elderly in America think of life of good quality as one in which they are self-reliant and live vigorously, one in which they participate actively, play a respected role in society, and have emotional, physical, and economic autonomy to the extent that is possible.

Today's human services policies arose under circumstances that did not recognize the elderly and the quality of their lives in these terms—terms of fitness and optimal function. Today's human services policies arose primarily in association with goals of preventing and treating acute disease, where the main goal was to increase the length of life. Happily, progress was made in conquering many acute diseases, and more people were helped to live out a longer life. The quality of that life was of less concern. Little attention was paid to preventing disability and to restoring active function to the best level possible.

National priorities which could and should promote lives of high quality for elderly Americans now need to be reordered. Information for use in this reordering is now available. We have, for example, increasing information about the kinds of amounts of dysfunctions and impairments among the Nation's elderly. We have increasing information about the available supply of services. We understand better the circumstances of service use—that is, whether such use is appropriate or inappropriate—and have begun to understand the health consequences and functional consequences—not only the disease consequences—of care.

For the first time, we have information about active life expectancy. You heard this morning about life expectancy and how long people are expected to live. Active life expectancy is a new concept, allowing us to examine how long they are expected to live without help from others.

We know, for example, that a person 65 to 70 in the State of Massachusetts has about a 10-year expectancy with regard to active life on the average and, as a result, about 7 years of dependency. This type of information can help to reshape long-term care by giving us improved actuarial information for financing long-term care. It can tell us about the functional health of different segments of the population, helping to discover particular needy groups. In that Massachusetts study to which I have just alluded, active life expectancy was shorter at every age group for the disadvantaged. It can help us to develop preventive approaches to disability.

Reshaping long-term care with a view to promote functional well-being requires a policy that integrates health, medical, and social services, and brings them together in such a way as to enable the elderly to remain at home as long as possible, with the aid of informal support from family and friends.

Current directions favor separateness of services, separateness of reimbursement, separateness of organization, and separateness of

planning. Importantly, our policies do not favor informal supports and self-reliance.

Different views of quality reinforce separateness by emphasizing different priorities. For example, some professionals emphasize services aimed at social and economic well-being. Other professionals emphasize services for mental and physical well-being. Other professionals emphasize services for disease.

Administrators may concentrate primarily on the number of units of a particular service that is delivered. Consumers may emphasize the ability to make their own choices among services.

Although each of these views is legitimate from the viewpoint of a special interest, maintaining separateness promotes fragmentation, inefficiency and ineffectiveness. Since coordinated activities and programs are essential, an important need is to articulate strongly everywhere we can a commonly supported principle of what constitutes a life of quality for elderly Americans, and to establish service policies based on that principle. The pursuit of policies that promote active functioning can be that principle.

In summary, reshaping national programs that concern the elderly through priorities that recognize their functional well-being and the quality of their lives in these terms is the challenge we face. I believe it can be met.

Thank you.

[The prepared statement of Dr. Katz follows:]

P.01

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The Quality of Life

(Testimony by Sidney Katz, M.D. - September 27, 1984)

Since World War II, the United States public has been increasingly concerned with issues of services, care, and cost. Our policies have supported the view that health care is a right and that quality must not be sacrificed. At the same time, expenditures for services have increased rapidly - especially, the proportion of government expenditures. Highlighting the problem, Judith and Lester have argued persuasively that issues of cost cannot be separated from issues of quality.

It is quite clear that the "graying of America" magnifies these concerns:

We live in a society where people live beyond the age of vigorous health.

We live in a society where one out of every twenty people is over the age of 75; By 2040, when the "baby boom" generation is elderly, almost one out of every ten people will be over the age of 75.

We live in a society where medical technology prolongs the lives of individuals who might have died otherwise from chronic illness, impairment or debilitating accidents.

We live in a society where many elderly cannot independently manage routine activities of living such as shopping, dressing or bathing.

We live in a society where too few are prepared to help the elderly live independently in the community.

We live in a society where nursing home expenditures double every five years, where Medicare cannot keep up with the cost of services, and where chronic conditions are the number one problems in care, in terms of both quantity and cost.

In my work, I often ask groups of elderly about their needs and wishes. Uniformly, they answer that they wish to live as independently as possible, as long as possible. They want to avoid being institutionalized. Most elderly Americans think of a life of good quality as one in which they are self-reliant and live vigorously - participating actively, playing a respected role in society, and having emotional, physical, and economic autonomy.

Current human service policies came about under circumstances that did not recognize the elderly and the quality of their lives in terms of function, that is, their ability to remain active. Current human service policies arose primarily in association with the need to prevent and treat acute diseases, and to increase the length of life. Progress was made in conquering acute diseases, and more people were helped to live out a longer life. The quality of that life was of less concern. Little attention was paid to preventing disability and to restoring and maintaining function at the best level possible.

National priorities which could and should promote lives of high quality for elderly Americans now need to be reordered. Information for use in this reordering is now available. We have, for example, increasing information about the kinds and amounts of disabilities and impairments among the nation's elderly - both in the community-at-large and in institutions. We, also, have increasing information about the available supply of services. We understand better the circumstances of service use (appropriate and inappropriate) and have begun to understand the health outcomes associated with care. For the first time, we have information about <u>active</u> life expectancy, that is about how long people can be expected to live <u>actively</u> - not only how long they can be expected to live. This type of information can help to reshape long-term care by contributing to an improved actuarial base for financing long-term care. It can tell us about

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the functional health of different segments of the population, thus helping to discover particularly needy groups. It can help us develop preventive approaches to disability.

Reshaping long-term care with a view to promoting functional well-being also requires a policy that integrates health, medical, and social services in such a way as to enable the elderly to remain at home as long as possible with the aid of informal support from family and friends. Current directions favor separateness of services, reimbursement, organization, and planning. Our policies do not favor informal support. Separateness is reenforced by differing views of which features of quality should receive priority consideration. For example, some professionals emphasize services aimed at social and economic well-being, while other professionals emphasize services for mental and physical well-being. Administrators may concentrate primarily on the number of units of particular services that are delivered, whereas consumers may emphasize the ability to make their own choices among services. Although each of these views is legitimate from a particular viewpoint, maintaining separateness promotes fragmentation, inefficiency, and ineffectiveness. Coordinated activities and programs are essential.

In summary, reshaping national programs that concern the elderly through priorities that recognize their functional well-being and the quality of their lives is the challenge that we face.

Senator PELL. Thank you very much, Dr. Katz.

Now, if Dr. Harvey would care to speak.

Dr. HARVEY. Senator Pell, thank you very much for this kind invitation to come and share with you some ideas on perspectives in longevity. Aging, geriatrics, and gerontology are very close to my heart and my professional life. I am delighted to be here with you and the committee to give you some of my thoughts.

You had asked me to talk a little bit about the duration of life, and particularly the well-publicized anecdotal reports of the long-lived people in Equador and in the Caucasus in Russia and in Pakistan, and I will do that.

I have some testimony to submit to you for the record. I will not read it all, but I will summarize a few thoughts that I have. As we heard from Dr. Katz, the life expectancy in America for a 65-year-old man is about another 14 years at the present time, and for a woman another 18 years, so that we are talking about lifespans of between 79 to 86 years, on the average.

These facts are important to understand when we study longevity curves and mortality rates. The theory that Prof. James Fries has postulated—Dr. Fries is at Stanford University—is that there is a finite lifespan. It is very reminiscent of Oliver Wendell Holmes' poem, "The Wonderful One Horse Shay," which you know about. It lived for 100 years to the day and then collapsed into a heap of dust!

Now, it appears that there is a finite life span when we study mortality tables. These have been looked at from existing records all over the world. Therefore, when we talk about aging and quality of life, we must not think we are looking for Ponce DeLeon's fountain of youth, even though everyone does look at that.

We are not trying to extend life, but to improve the quality of life as it exists during its finite span. One of the great physicians at the medical school of the University of Pennsylvania in the 1930's, George Morris Piersol, said in regard to this: "We are not trying to add years to life, but we are trying to add life to years."

There are some very widely reported, anecdotally studies of long-lived populations in Equador and in the Caucasus the Central Asia. If I may, because I have a tendency to talk too much, I would just like to read a few of the paragraphs which I have submitted in my written testimony.

Senator PELL. Your whole statement will be inserted in the record as if read.

Dr. HARVEY. In 1971, the National Institute of Statistics in Equador recorded statistics concerning the high Andean village of Vilcubamba. Of the total population of 819 souls, 9 were over the age of 100 years and 16.5 percent of the village population was over 60, which contrasted very much to the rural Equador population as a whole, where there were only 6.4 percent of the population over 65.

While many of the members of this population boasted of being centenarians and over, the baptismal records of the parish church when studied showed that there were only really nine centenarians.

This population, and studies which were made upon it by a team of anthropologists, sociologists, and medical scientists, were report-

ed anecdotally by Prof. Alexander Leaf of the Harvard Medical School and the Massachusetts General Hospital.

Senator PELL. Excuse me. Where was this group of people?

Dr. HARVEY. In the village of Vilcubamba in the high Andes of Equador.

Senator PELL. The high Andes.

Dr. HARVEY. Dr. Leaf reported this anecdotally in the "Scientific American" in 1973. In addition, he studied a village in the remote mountain regions of Pakistan near the border of China and Afghanistan, the village of Hunza. Again, the study of this population, with limited education, no written language, no records of birth dates such as the baptismal records of Vilcubamba—could not confirm the presumed longevity of the inhabitants of the village.

Now, nutritional studies in both of these villages showed that the average caloric intake of the adult was between 1,200 and 1,600 calories, with limited protein and fat content and large amounts of carbohydrate. In both villages, there was no modern sanitation nor medical care. Living conditions were primitive and infant mortality was high.

The mountainous terrain was challenging and demanded vigorous physical activity from all people who had to work hard to make a living from the rocky hills. Both villages had evidence of almost unique genetic isolation, and this tends to confirm Dr. Fries' theory.

Now, Dr. Leaf also observed old people in the Caucasus Mountain in Southern Russia. There are many old people in the mountainous regions of the Soviet Republics of Georgia, Azerbaijan, and Armenia. He could not examine vital statistics and thus could not confirm the reports of very advanced ages that is 140 or 160 years. Here, the incidence of arteriosclerosis among the mountaineers was about half that found in the populations of the villages at sea level.

The Soviet Union, in its 1970 census report, reported that the total number of centenarians in the Caucasus was between 4,500 and 5,000 souls. The incidence for the group was 39 per 100,000 in the Soviet Republic of Georgia and 63 per 100,000 in the Soviet Republic of Azerbaijan.

In the United States, the incidence of centenarians is about 3 per 100,000. The gerontological center in the Soviet Republic of Georgia reported 15,000 persons over the age of 80, of whom 70 percent led active, vigorous lives. This group has been very well publicized, as I have said, anecdotally in pictures and reports.

But when close, limited studies have been made, and there have been few, it is obvious that there are no vital statistics which can be validated to prove the unique long-lived populations in these three Soviet republics. Certainly, in these areas age appears to be venerated and older people lead a very active, vigorous life into advanced age. Work is hard and out of doors, farming mostly. And diet here, too, is restricted in calories, fat, and protein.

I also report on Dr. Leaf's studies on the Canadian male survivals, comparing them to Indian women survivals, and the end result is that the curves all end up the same on the same point in the baseline between 90 and 100 years of age.

In other words, what I am saying is that these very widely anecdotally reported studies tend really to confirm Dr. Fries' theory

that genetics has a great deal to do with aging and that there is a finite number of years for life.

What lessons can we learn from these perspectives on longevity? We see that the elderly in our society are survivors. There is great individual variation among the survivors. Aging is a loss, as Dr. Katz has pointed out, and there is variation in these losses and the fears that older people have.

What can we do to help? Well, first of all, I think we can follow the leads of the great pioneers. Dr. Ignatz Leo Natcher, a physician in New York City who first coined the term "geriatrics," back in 1914, was one of the founding fathers of the various gerontological associations in the United States.

The great Dr. Marjory Warren and Sir Fergrerson-Anderson of the United Kingdom pointed the way to community social support systems to prevent institutionalization of our elderly population. And then we have the biological scientists like Profs. Leonard Hayflick, Harold Brody, Nathan Shock, Caleb Finch, and Vince Christofolo, who are leading students of the biological process of aging.

What can we do? Perhaps a combination of private enterprise support and Government support for activities must be encouraged and extended. At a national level we must continue the support for the National Institute of Aging, the Social Security System, and medicare; on a local level, continue the efforts of the Administration on Aging and its community partners. We have such an example as right here in northwest Washington where we have 25,000 single women over the age of 65 living north of Reservoir Road and between Rock Creek Park and the Potomac River.

Here in northwest DC, we have a wonderful senior citizens' center supported by the Office of Aging of the District of Columbia and a consortium of the churches and synagogues in the northwest area, Iona House. I will submit for the record some of the information which the Iona House has published describing its programs.

Well, I hope, Senator Pell, that the lessons that are learned from some of these perspectives which I have gone into in more detail in the prepared statement will be useful to you and the members of the committee in your activities in the legislative area to improve the quality of life for senior citizens as they live out their genetically fixed lifespans in dignity and tranquility, free from the fears of isolation, insolvency, unattended illness, and dependency.

Thank you very much.

[The prepared statement of Dr. Harvey follows:]

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Remarks by: Dr. John Collins Harvey, M.D.
Professor of Medicine
Georgetown University

PERSPECTIVES IN LONGEVITY

Studies published by the Federal Council on Aging in 1981 showed that on average 65 year old women could expect to live another 18 years, and a 65 year old man another 14 years to 83 years and 79 years respectively. A woman age 75 could expect to live another 11 years to age 86, and a 75 year old man could expect to live another 7 years to age 82 years. An 85 year old woman could expect 7 more years of life to age 92 while an 85 year old man could expect to live about 5½ more years to 90½ years of age!

It has been postulated that this increased life expectancy is due to improvement of environmental conditions and the prevention of premature deaths by the control of disease - particularly infections in infancy and youth.

Life expectancy in 1850 was 40 years of age; in 1900 it had risen to 47 years of age. Projections based on actuarial studies of major life insurance firms, of the Census bureau, and of the Social Security system showed that life expectancy in 1940 was 47 years , and in 1971, 63 years.

The major causes of death in 1900 in the United States were influenza and pneumonia, tuberculosis, and diarrhea and enteritis. In 1978 the three major causes of death were heart disease, cancer, and stroke with trauma a close fourth. These causes are conditions which are associated with degenerative processes and have a strong genetic component. Dr. Edward J. Stieglitz, one of the pioneers in geriatrics and gerontology who was a Professor of Medicine at Georgetown Univesity and Medical Director of the Washington Home (formerly the Home for Incurables) here in Washington said in 1946:

> "Biology and Medicine have already shown that better hygiene, better medical guidance, and living in accordance with today's understanding of the nature of man will delay the time of onset and decrease the severity of these impairments and thus increase the years of possible service and happiness of the aging citizen."

This suggests that if all disease could be eliminated from man, life might continue indefinitely! ——but such is not the case.

George Morris Piesol, a great physician and medical professor in the University of Pennsylvania back in the 1930's prophetically said that gerontology —— the study of the aging process —— was not to add more years to life but to add more life to years! The search of Ponce de Leon for the fountain of youth has not really ceased even to this time ——despite the admonitions of physicians such as Piesol.

Dr. Janus Friis, Professor of Medicine at Stanford University, has proposed a theory that there is a definitive length of human life and when trauma and disease are eliminated from human life, that there is a natural span of about 84 years on the average. His theory based upon his studies of age mortality rates and acuarial tables of the major life insurance companies, the holders of the best statistics on longevity —— is intriguing and suggests that there is an internal biological clock that is genetically determined.

Indeed many biologists of aging have subscribed to the biological clock theory of aging. Professor Leonard Hayflick, formerly of the Wistar Institute, now at the University of Illinois, in classical studies of cultured human embryonic fibroblasts showed that there was a finite number of cell divisions in the cultured cell population, namely 20. If damage from internal and external factors is removed the biologic clock may run its full course. This is reminescent, of course, of Oliver Wendell Holmes's poem - the Wonderful One Horse Shay ——

> Have you heard of the Wonderful One Horse Shay
> That was built in such a logical way

It ran a hundred years to a day! etc, etc.

It appears that the genetic aspects of aging if not controlling have a large part in determining aging in the organism. When genetic instability appears there is a progressive accumulation of faulty copying in dividing cells so that there is an accumulation of errors in information containing molecules. This progressive accummulation of errors in transcription functions could act to initiate secondary changes which would ultimately be manifested in biolgoical aging.

Populations which appear to be homogeneous and long lived have been studied to see what part those factors of genetics, environment, and disease may play in the aging process. Such populations have been found in Ecuador, Pakistan, and the USSR.

In 1971 the National Institute of Statistics in Ecuador recorded statistics concerning the high Andean Village of Vilcubamba. Of the total population of 819 souls, 9 were over 100 years of age, and 16.4% of the population was over the age of 60 — which contrasted with the percentage of the population of rural Ecuador as a whole. In their population, only 6.4% were over age 65. While many of the numbers of the population figure boasted to be centenarians the baptismal records studied showed that only nine persons were. This population and the studies made by a team of anthropoloigsts, sociologists, and medical scientists were reported anecdotaly by Professor Alexander Leaf of the Harvard Medical School and the Massachusetts General Hospital in the "Scientific American" in 1973. Leaf reported a similar group of long lived people in another remote and circumscribed community in Pakistan. The Village of Hunza was in a mountain Valley in the Karakorum range in Kashmir near the Pakistanian border with China and Afghanistan. In this village the people are Ismaili Moslems with limited education, with no written language, and no records of birthdates such as the baptismal records of Vilcabamba. The

study team could not confirm therefore the presumed longevity of the inhabitants of the village. Nutritional studies in both villages showed that the average caloric intake of the adult was 1200 - 1600 calories with limited protein and fat content, and large amounts (200-300 grams) of carbohydrate. In both villages there was no modern sanitation, nor medical care —— living conditions were primitive and infant mortality was high. The mountainous terrain was challenging and demanded vigorous physical activity from all people who had to work hard to make a living from the rocky hills. Both villages had evidence of almost unique genetic isolation.

Dr. Leaf had also observed old people in the Caucasus in Southern Russia. Many old people were in the mountainous regions of the Soviet Republics of Georgia, Azerbaijan, and ~~Asmernia.~~ Armenia. The incidence of arteriosclerosis among the mountaineers was only half of that found among the populations in the sea level villages in these republics. The 1970 Census in the Soviet Union reported the total number of centenarians in the Caucasus was 4,500 - 5000. The incidence for the group was 39/100,000 in the Soviet Republic of Georgia, and 63/100,000 in Azerbaijan. In the United States the incidence of centenarians is 3/100,000 . The Gerontological Center in the Soviet Republic of Georgia has recorded 15,000 persons over the age of 80, of whom 70% lead active vigorous lives. This group has been well publicized in pictures and anecdotal reports from Russia, but when limited close studies have been made, it is obvious that there are no vital statistics which can be validated to prove the unique long lived populations in these three Soviet Republics. Certainly in these areas, age appears to be venerated. Older people lead very active vigorous lives into advanced age. Work is hard and out of doors —— farming mostly —— and diet here, too, is restricted in calories, fat, and protein.

Leaf has studied cross sectionally numbers of survivors of Canadian males

in the years 1926, 1950-52, and 1970-72. The ~~groups~~ graphs based on these data demonstrate that reducing infant mortality rates is the major factor in increasing life expectancy. When one ~~controls~~ compares the Canadian male curves with one of Indian women in whom the infant and child mortality was high one sees that the curves ~~lines~~ all end at the same point on the base line --- between the ages of 90 and 100 years. All the advances in public health and imporvement in the environment plus the small contributions of therapeutic medicine have succeeded in saving many infants and younger people but not in increasing the longevity of the species. Similar survival curves for other mammals are available and reveal the same situation. Each animal species has its own characteristic life span. The ~~shap~~ shape of survival curves may be varied by environmental or therapeurtic measures, but these influences have not affected the ~~mena~~ mean length of life of the species. For every species, even under optimal conditions, the span of life is fixed.

The works of ~~Strogitz~~ Strehlitz and Pearsol were indeed prophetic! What lessons can we learn from these perspectives on longevity?

We can see that the elderly in our society are survivors. One principal of aging is individual variations among these survivors. Aging is a loss of a social role --- in retirement --- loss of income, and loss of friends and relatives together with a collection of fears --- fear for safety, fear of financial insecurity and fear of dependency. There is variation in these losses and fears in our older people just as there is great variation in their physiological changes. We know that chronological age has no relation to physiological age. We can see then that the needs and wants, the abilities and disabilities, the wellness and illness of the geriatric population varies greatly. We must follow the lead of those individuals who have started the study of the aging process and the care of of the aged person --- people like Dr. ~~Ignaty~~ Ignatz Leo Natcher who coined the term geriatrics and started this medical speciality in the USA in 1914, of Dr. Marjory Warren

and Sir Fergrerson-Anderson both in the United Kingdom who have pointed to the need for social support systems in the community to prevent institutionalization of our elderly population, and of biological scientists like Professor Leonard Hayflick, Harold Brody, Nathan Shock, Caleb Finch, and Vincent Christofolo who are leading students of the biological processes of aging. A combination of private enterprise support and government support for these activities must be encouraged and extended. At a national level we must continue to support the National Institute of Aging, the Social Security System and Medicare; on a local level the efforts of the Administration on Aging and its community partners --- such as that in Northwest Washington where between Rockcreek Park and the Potomac River, North of Reservoir Road to Western Avenue, the cachement area for the Georgetown University Hospital, there live 25,000 single women over the age of 65 with Iona House as their Community senior social service center --- a center supported by a group of Churches of all faiths in the area in partnership with the DC Administration on Aging. The partnership established Iona House as a nonprofit ecumencial social service center in 1975 to offer information and services to older people in this northwest community. Its achievements have been truly monentous! It serves as an example of what can be done at the local level by private enterprise and government activity.

I would hope, Senators, that the lessons learned from these perspectives would be useful to you in your activities in the legistlative area to improve the quality of life for senior citizens as they live out their genetic fixed lifespans, in dignity and tranquility, free from the fears of isolation, insolvency, unattended illness, and dependency.

Senator PELL. Thank you very much, Dr. Harvey.

Now, Dr. Allan Goldstein, chairman of the Department of Biochemistry at George Washington University Medical Center. Dr. Goldstein?

Dr. GOLDSTEIN. Senator Pell, I will also, for the sake of brevity, abstract my written testimony.

Senator PELL. Fine, and the full text will appear in the record as if read.

Dr. GOLDSTEIN. My name is Allan Goldstein. I am professor and chairman of the Department of Biochemistry at the George Washington Medical School here in Washington. I would like to discuss the progress that we have made in research that offers the hope of significantly improving the quality of life of the elderly.

I would also like to bring to the attention of your committee serious problems that are clouding an otherwise rosy picture. My area of expertise is as an educator and as a basic research scientist in the fields of biochemistry and immunology.

I am the codiscoverer of the thymosins, a family of hormones produced by the thymus which control our immune system. It is a tragedy of life that we spend so many years trying to gain wisdom, and by the time we are able to put it all together our bodies fall apart and we become more susceptible to disease.

Scientists in the laboratory are beginning to get a fix on the central reasons for the downhill slide of health that begins in middle age. Much of it hinges upon the immune system.

Far-reaching advances have occurred over the past 5 years which have made it possible for the first time to begin to understand how the immune system works. The potential of using the body's own natural immunity to deal with disease on a rational basis may well become the most dramatic development that has occurred in medical science in this century.

We have the possibility to help improve the health and quality of life of the American public dramatically in our lifetime and, in particular, the elderly, whose immune systems are weakened.

If we are successful, we should be able to dramatically decrease the health care costs of the elderly that are draining our economy. We are just beginning to translate many laboratory discoveries of the 1960's and 1970's to the treatment and perhaps prevention of diseases in the elderly. However, the funds are not there to take full advantage of the advanced state of our scientific know-how. It would be as if we had the space shuttle on its pad with a payload of satellites and astronauts all buckled in and no fuel in the fuel tank to allow us to take off on our mission.

The investment we have made in supporting innovative research in the 1960's is paying off a hundredfold in new drugs and new therapies to better treat diseases, as well as in helping to develop new industries to heal our economy.

Unfortunately, we are not continuing that commitment. For the past several years, we have been seeing the tragic decline in Federal support, a decrease in graduate enrollment, a deterioration of laboratory equipment, and an increasing shortage of capital investment for basic research. This lack of vision by Government will come back to haunt us for sure.

We are not only delaying the opportunity to improve the quality of life for the elderly, but in a broader sense we are risking the future of our children and grandchildren. Instead of reaping the fruits of a bountiful harvest, our children may have to settle for hand-outs from other nations.

As our own support for basic science has been declining, other nations like Japan, Germany, Italy, France, and many others, have benefited by sending their students and scientists to the United States to learn from our professors and to acquire our technology.

They are now in many cases spending more money to support new, basic research than we are. It is currently easier for a foreign scientist to come to the NIH with U.S.-derived fellowship support than it is for an American to do the same. To me, this makes very little sense.

There are a number of questions which must be answered. I would like to know why the National Institute of Aging that is doing such important work and has the greatest responsibility to the elderly has the second lowest funding of any institute at the NIH.

I would like to know why money for basic and clinical research is at such a low priority in fiscal year 1984 that only 29 percent of the scientifically approved grants can be funded by the NIA. The same is true at the other institutes of the NIH.

I would like to know what this committee will be doing specifically to enact new legislation to ensure that our Nation will be able to respond properly to the elderly who are on the front lines in the war against the diseases of aging.

I think it is important to tell your colleagues in the Senate and in the House that a good many of the scientific and medical breakthroughs of the 1960's and 1970's that are currently being applied to treat the sick and elderly would not have been discovered in 1984 because of lack of adequate funding.

It is a tragedy that less than one-third of all scientifically approved research grants can be funded today, in contrast to 80 to 90 percent in the mid-1960's. It is a terrible legacy to be leaving our children and grandchildren.

I believe your committee can help to correct this situation by formulating a simple bill that would provide new funding to the NIH to accomplish two major objectives. These are: one, to establish a significant number of new Ph.D. graduate training programs in each of the biomedical disciplines to encourage graduate students from America to enter science as a career goal; and, two, to mandate that the percentage of funded research grants be restored to the funding level it was in the mid-1960's.

The overall financial cost of a new investment in the future would more than pay for itself, as it has paid for itself in the past. An increased investment by government in science would do the following.

It would modernize our scientific laboratories, restore the integrity of our basic research programs, and give our scientists and students the opportunity to once again explore the unknown.

Because of the lack of adequate research dollars, our scientists have been shifting from creative, high-risk, high-payoff research

which characterized American science from the early 1900's until the Vietnam era, to safer, low-risk, largely pedestrian research.

The problem with this approach is that it stifles discovery, which is the hallmark of scientific progress. It would enhance the lead we have in the development of new biomedical technology. It would restore the quality of our graduate educational system and help motivate our children to become interested in careers in science and biomedicine.

Finally, it would improve the quality of life for the elderly and for all Americans. It is only through a healthy research environment that discoveries can be made which will lead to new drugs and therapies to treat and prevent the diseases of aging.

If we are successful, our senior citizens will be able to live longer, healthier lives, and we will be able to lower the cost of health care. With a stroke of your pen and a relatively small investment, Congress can do more to ensure the future health of the elderly and all Americans by reestablishing graduate education and basic research as a high priority item.

Thank you.

[The prepared statement of Dr. Goldstein follows:]

September 27, 1984

STATEMENT OF ALLAN L. GOLDSTEIN, PH. D., PROFESSOR AND CHAIRMAN, DEPARTMENT OF BIOCHEMISTRY, GEORGE WASHINGTON SCHOOL OF MEDICINE, WASHINGTON, D.C.

To the U.S. Senate Subcommittee on Aging

Mr. Chairman and distinguished members of the Subcommittee on Aging, my name is Allan L. Goldstein. I am Professor and Chairman of the Department of Biochemistry at the George Washington University School of Medicine and Health Sciences in Washington, D.C.

It is a privilege to have the opportunity to address your committee to discuss the progress that has been made in research that offers the hope of significantly improving the quality of life of the elderly in the near future.

I would also like to bring to the attention of your committee some significant problems that are delaying the full application of some of the most important biomedical research developments and will seriously restrict the ability of American universities to train the next generation of scientists necessary for the discovery of new knowledge.

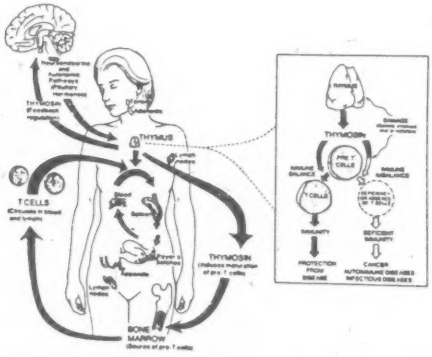
My area of expertise is as an educator and as a basic research scientist in the fields of biochemistry and immunology. I am the codiscoverer, with the late Dr. Abraham White, of the thymosins, the family of hormones produced by the thymus which controls our immune system, and have been directing the research efforts on the thymosins from their discovery in 1965 to the initiation of clinical testing of thymosin in children with life-threatening immunodeficiency disease and most recently in patients with cancer and other diseases of aging.

It is now generally recognized that the thymus gland, as shown in Figure 1, is the master gland of the immune system and is vital to the normal development and function of the immune system and is involved directly in the aging process. As we age, the thymus gland does not function properly and our immunity declines.

As there are thus obvious implications for thymosin in aging, I have had the opportunity, by my work in this area over the past 20 years, to gain a degree of insight into the progress that is being made in biomedical research as it relates to aging and to analyze the potential that exists for translating these discoveries into meaningful clinical applications to treat many of the diseases of aging, i.e., cancer, autoimmune diseases and infectious diseases.

FIGURE 1

The thymus is the master gland of the immune system. It secretes thymic hormones (thymosins) which regulate immunity. Several of the thymosins appear to act at the level of the brain and stimulate the neuroendocrine system.



From my vantage point, there is absolutely no doubt that, if major advances are to be made in truly improving the treatment and health care available for our senior citizens, it will come about only by making progress in biomedical research.

In my judgment, new emphasis on improving the quality of life should focus on means to increase research in aging.

It is a tragedy of life that we spend so many years trying to gain wisdom and by the time we're able to put it all together, our bodies fall apart and we become more susceptible to disease.

Scientists in the laboratory are beginning to get a fix on the central reasons for the downhill slide of health that begins in middle age. Much of it hinges on the immune system. Far-reaching advances have occurred over the past 5 years, which have made it possible for us to begin to understand how the immune system works.

We have isolated and chemically characterized many of the hormones and soluble mediators (natural drugs) of immunity such as the thymosins, lymphokines and interferons.

Through the development of hybridoma technology, we are making potent monoclonal antibodies by fusing antibody producing cells and are developing powerful new diagnostic weapons and new drugs to treat cancer and other diseases of aging.

With this knowledge, which has come primarily from the lab bench, we have begun the process of technology transfer and are developing new and powerful weapons to fight disease.

Indeed, the decade of the 80's, I believe, is ushering in a new age which should properly be called the "Age of Immunopharmacology". Through the thymosins, monoclonal antibodies and other biological response modifiers, we are beginning to learn how to manipulate and harness the energy of the body's immune system in the same way that we have learned to harness the energy of the atom. Almost certainly, this information will translate itself into the conquest of many diseases which are thought today to be "incurable".

thymus belongs in the uscless "leftover" category with the appendix. In fact, the decline of the thymus with age has been implicated in the beginning of the aging process itself.

Recently, as shown in Figure 1, it has been found that the thymosins also appear to play a role in regulating other key hormone systems located in the brain - hormones such as luteinizing releasing factor (LRF) and luteinizing hormone (LH) which regulate the reproductive system. A direct link has also been found between the thymosins and the hormones of the adrenal glands - the glands which respond to stress. Thymosin fraction 5 has been found to stimulate the production of ACTH, the hormones that stimulate cortisone, which helps relieve rheumatoid arthritis and beta endorphin, the "feel good" hormone that is released during jogging, sex and childbirth and is one of the natural opiates of the body.

The discovery of a thymus-brain relationship may help us unravel the mystery of what causes human aging. One theory is that aging is related to the inability of the brain to produce and control certain hormones. The latest research in this area indicates that thymosin may be among the critical regulating factors of brain hormonal activity and thus may well be a key to determining the cause of senescence of the immune system and other endocrine systems that occurs with aging. This is encouraging inasmuch as the immune system workings are now accessible to clinical intervention. And the hormones of the thymus are likely candidates for providing a new generation of drugs. The possibility of using thymosins to delay the aging process has generated considerable interest in the scientific community.

The first clinical trials with thymosin to deal directly with the elderly population is a study about to be started by Dr. William Ershler, at the University of Vermont School of Medicine. He plans to see if it is possible

Our understanding of the immune defense system and the role of the thymus did not begin to emerge until the early 1960's. Without the thymus, we now know, life itself would be impossible. Until just a few years ago, children unfortunate enough to be born without a functioning thymus usually died in early childhood of overwhelming infections or were destined to spend their lives in plastic germ-free bubble enclosures. The only way youngsters with such rare primary immunodeficiency disabilities could venture out into the world was in specially designed space suits as if they were aliens on their own planet. In fact, in many ways we are all aliens on our planet. We live in a hostile environment, surrounded by thousands of potentially lethal germs. We are bombarded constantly by cancer-inducing ionizing and ultraviolet radiations released from the sun and the confines of the earth. We breathe and eat the toxic chemicals of an industrialized society.

What saves us from an otherwise cataclysmic destiny is our immune system. In effect, we each have our own protective immunological bubble which defends us on a day-to-day basis from a hostile environment. This protective bubble has such an impressive array of defensive and offensive weapon systems at its disposal that its complexity would make our most sophisticated atomic based military defense systems seem like children's tinker toys in comparison.

And yet, despite what we now realize - that the thymus plays one of the most, perhaps even the most, critical of roles in the immune system - scientists believed, until the early sixties, that the gland was only a vestige of evolution, much like the appendix, with no important function.

Indeed, research on the decline of the body's immune defenses that occurs with age has established that the thymus mysteriously begins to shrink with the onset of puberty. It is the first gland in the body to decline and at an age when other organs are still growing. But this hardly means that the

to increase the efficacy of an influenza vaccine by boosting the immune system in individuals over the age of 65 with thymosin. Influenza is still a major cause of death in the elderly despite the immunization programs currently available. This is because the immune systems of the elderly are depressed so the available vaccines are not very effective. Dr. Erahler has evidence that he can stimulate immunity of his older patients by adding thymosin to their cells *in vitro*. He hopes to accomplish the same results *in vivo*.

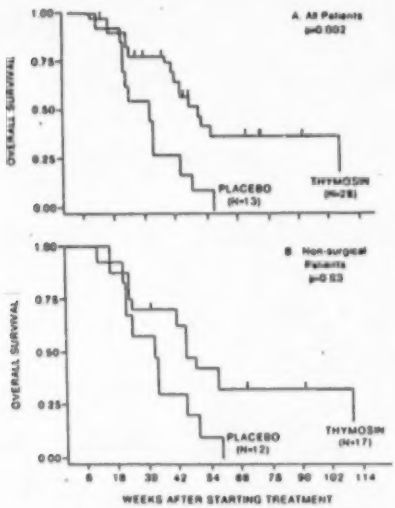
A prime example of the transfer of technology in biomedicine from the lab bench to the clinic is the successful utilization of thymosin to reconstitute the immune systems and prolong life in critically ill children born without functioning thymus glands and the encouraging preliminary reports that thymosin significantly prolongs survival in lung cancer patients when added to the normal therapy.

Dr. Richard Schulof and his clinical colleagues at the George Washington University Hospital have just completed the first randomized double blind trial of a synthetic thymosin, termed thymosin α_1, in a study sponsored by the Biological Response Modifier (BRM) Program of the National Cancer Institute. In this study, of 45 patients treated with a combination of thymosin and radiation, it was found (as shown in Figure 2) that when thymosin was given with radiotherapy there was a significant increase in the disease-free interval and survival in comparison to patients receiving placebo. The thymic dependent immunity of patients receiving thymosin was also significantly improved.

On the basis of the positive results, the National Cancer Institute is sponsoring a large confirmatory Phase II/III trial with thymosin through it's radiation therapy oncology groups (RTOG) in 300 patients at 20 medical centers

FIGURE 2

Thymosin alpha 1 increases survival of patients with non-small cell cancer of the lung when given within a week of radiotherapy. Data from the study of Dr. Richard Schulof of the George Washington University Medical School, 1984.



throughout the country. Alpha 1 Biomedicals, Inc. is providing the thymosin for these trials and has developed new procedures which will allow large scale chemical synthesis of this important hormone for further clinical trials in other areas.

Thymosin and thymosin-like preparations are also being tested in patients with autoimmune diseases such as multiple sclerosis, systemic lupus erythematosus (SLE), and rheumatoid arthritis, all diseases characterized by an immune imbalance. Autoimmuine diseases are caused by immune system attack on one's own tissues. These kinds of disease occur frequently as we age. There are approximately 200 research centers in the United States and Europe conducting research on thymosin and over 30 clinical centers carrying out trials on thymosin in man.

If the thymosin lung cancer trials, are successful, within 3 years thymosin will have a major impact on the current treatment of cancers. Lung cancer leads all cancers as a killer. There are over 150,000 new cases of non-oat lung cancer in the U.S. each year and the prognosis is dismal. We are hopeful that thymosin will be the first of a new class of compounds, called "Biological Response Modifiers (BRM's)", that may well be the wave of the future in treating not only cancer but a large number of other serious diseases including many of the debilitating diseases of aging. The BRM's, like the thymosins and interferons, are presently being developed at an accelerated pace by the collaborative efforts of the scientific community, and the pharmaceutical industry, and most importantly, the government.

Recognizing the potential importance of these new agents in treating cancer, the NCI in 1979, with the help of increased funding by the Congress, started a national program to focus and accelerate basic research and clinical application in this area. There are equally exciting advances occurring in other areas of biomedicine which could rapidly be applied directly to the treatment of many of the diseases of aging and perhaps aging itself. However, we must first learn a great deal more about the basic biology and biochemistry of aging.

This is the ideal time for a new concerted effort to capitalize upon the far-reaching advances that have occurred in key areas of biochemistry, immunology and molecular biology and genetics and apply them to the study and treatment of the diseases of aging.

The potential of using the body's own natural immunity to deal with disease on a rational basis may well become the most dramatic development that has occurred in medical science in this century. We have the possibility to help improve the health and quality of life of the American public

dramatically in our lifetime and in particular the elderly whose immune systems are weakened. If we are successful, we should be able to dramatically decrease the cost of health care of the elderly is draining our economy.

If we can translate these discoveries, our senior citizens should be able to live longer and healthier lives.

Unfortunately, we have given short shrift to the elderly who are most at risk to develop cancer and to succomb to infectious diseases and other diseases of aging. What we need most at this pivotal point is to encourage the rapid transfer of technology from other scientific disciplines like molecular biology and immunology to the field of aging and to increase the funding to accelerate the development of this area.

We are just begining to translate many laboratory discoveries of the 1960's and 1970's to the treatment and perhaps prevention of diseases in the elderly, however, the funds are not there to take full advantage of the advanced state of our scientific knowhow. It would be as if we had the space shuttle on its pad, with its pay load of satellites and astronouts all buckled in and no fuel in the fuel tank to allow us to take off on our mission.

- The tremendous investment our government made in basic research in the 1960's is bearing fruit as witnessed by the burgeoning fields of cell and molecular biology and immunology and the development of the biotechnology industry.

The investment we made in supporting innovative research has paid off 100-fold in new drugs and new therapies to better treat diseases as well as in helping to develop new industries to heal our economy as well. Unfortunately, we are not continuing that commitment.

For the past several years we have been seeing the tragic decline on federal support, a decrease in graduate enrollments, a deterioration of

laboratory equipment and an increasing shortage of capital investment for basic research. This lack of vision by government will come back to haunt us for sure.

We are not only delaying the opportunity to improve the quality of life for the elderly but in a broader sense we are risking the future of our children and grandchildren.

Instead of reaping the fruits of a bountiful harvest, our children may have to settle for handouts from other nations. As our own support for basic science has been declining, other nations like Japan, Germany, Italy and France and many others, have benefited by sending their students and scientists to the United States to learn from our professors and to acquire our technology. They are now, in many cases, spending more money to support new basic research than we are.

It is currently easier for a foreign scientist to come to the NIH with a U.S. derived fellowship support than it is for an American to do the same. To me this makes very little sense.

There are a number of questions that must be answered:

Question - I would like to know why the National Institute of Aging that is doing such important work and has the greatest responsibility to the elderly has the second lowest funding of any other Institute of the NIH?

Question - I would like to know why money for basic and clinical research is at such low priority that in fiscal year 1984, only 29% (135 of 461) scientifically approved grants can be funded by the NIA? The same is true at other institutes of the NIH. This lack of money for basic and clinical research will prevent us from adequately developing new treatments to fight disease and improve the quality of life for the elderly and other at risk populations in America.

Question - I would like to know what this Committee will be doing specifically to help enact new legislation to ensure that our nation will be able to respond properly to the elderly who are in the front lines in the war against the diseases of aging?

- I think it is important to tell your colleagues in the Senate and in the House that a good many of the scientific and medical breakthroughs of the 1960's and 1970's that are currently being applied to treat the sick and the elderly, would not have been discovered in 1984 because of lack of adequate funding.

- It is a tragedy that less than one-third of all scientifically approved research grants can be funded today in contrast to 80-90% of approved grants in the mid 1960's.

- It is a terrible legacy we are leaving our children and grandchildren.

Recommendations

I believe your committee can help to correct this situation by formulating a simple bill that would provide new funding to the NIH to accomplish two major objectives. These are

1) To establish a significant number of new Ph.D. graduate training programs in each of the biomedical disciplines (biochemistry, pharmacology, immunology, physiology, etc.) to encourage graduate students to enter science as a career goal; and

2) To mandate that the percentage of scientifically approved investigator-initiated (R01) research grants be restored to the funding level it was at in the mid 1960's. This would require a doubling of the current funding for basic biomedical research, i.e. from about 2 billion dollars to 4 billion.

- As a nation, we are currently reaping the fruits of the harvest of the

1960's in science. The rewards are obvious. A simple return to the formula of the past is all that is necessary. A priority score up to 250 should be fundable.

- The overall financial cost of this investment in the future would more than pay for itself as it has paid for itself in the past. An increased investment by government in science would:

1) Modernize our scientific laboratories, restore the integrity of our basic research programs and give our scientists and students the opportunity to once again explore the unknown.

- Because of the lack of adequate research dollars, our scientists have been shifting from the creative, high risk (high payoff) research which characterized American science from the early 1900's until the Vietnam era to safer, low risk research. The problem with this approach is that it stifles discovery which is the hallmark of scientific progress.

2) Enhance the lead we have in the development of new biomedical technologies.

- The billions of dollars invested by industry in biotechnology, (discovered primarily by scientists supported by NIH grants) has helped spur our economy over the last 5 years and will have the opportunity to help produce even more jobs and further stimulate our economy in the future. It is estimated that the biotechnology industries will be valued at over $250 billion dollars within the next 15 years.

3) Restore the quality of our graduate educational system and help motivate our children to become interested in careers in science and biomedicine.

4) Improve the quality of life for the elderly and for all Americans.

It is only through a healthy research environment that discoveries can be made which will lead to new drugs and therapies to treat and prevent the diseases of aging. If we are successful, our senior citizens will be able to lead longer healthier lives and we will be able to lower the cost of health care.

- With a stroke of your pen and a relatively small investment, Congress can do more to ensure the future health of the elderly and all Americans by reestablishing graduate education and basic research as a high priority item.

Secrets for a long life

'Marry a good cook'

By FREDERICK M. WINSHIP
United Press International

AMERICA'S CENTENARIANS, its smallest minority, are at last on record with advice for future generations.

They recommend honesty, religious faith or an inner spiritual calm, vigorous physical activity and attention to diet as keys to long life, or at least a long life worth living. This rare insight into the views of the oldest of our elder citizens is the result of a survey carried out by Northwestern Mutual Life Insurance Company.

It sent out questionnaires to 80 policy holders who have lived 100 years and beyond and received 31 replies, all from men.

"Marry a good cook," was the advice of more than one of those surveyed to youngsters of their own sex.

Northwestern Mutual decided to release its findings because "those members of the younger generations who feel they have to search the far corners of the Earth for a spiritual philosophy might do well to seek the thoughts of elders in their own backyard," according to Donald Schaenke, company president.

"PERHAPS IN AN AGE of anxiety the secret of life is indeed what these elders suggest — lead an honest existence and find inner peace," Schaenke said.

Of the life factors that appear most significant to the centenarians, honesty was mentioned most frequently, with an optimistic view of life and people running a close second.

"Be honest in dealing with people; be good to others and they will be good to you," wrote Adolf Draeger, 100, of Cathedral City, Calif.

"Have an affirmative, positive attitude toward the power of good thoughts and deed," said David Atkinson Sr., 101, of Bethlehem, Pa., summing up a sentiment mentioned by a number of other 100-year-olds whose occupations covered a wide range — from farmer, the most frequently mentioned profession, fishermen and miners to lawyers, professors and bank presidents.

As for longevity itself, it was variously ascribed to God's bounty, good habits, hard work, and no smoking or drinking. Heredity was mentioned often, as in the case of Charles B. Gates, 101, of Sun City West, Ariz., who said, "I like to suggest to those seeking long life that choice of father and mother is very important."

Conversely, Charles W. Stark, now living in Philadelphia, who described himself at 101 as Harvard's oldest living graduate, said the most important thing he wanted to pass on to future generations is "good genes".

Many of the respondents mentioned eating only fresh, wholesome food. Some eat bacon and eggs breakfasts with jam and coffee and two other full meals a day. Others still consume alcohol daily.

"Beer, wine and whiskey are OK in moderation, but if you can't handle it, drop it," advised Dr. George Stratton, 102, of Miami, Florida. "I have reduced mine to one bourbon highball a day, and since I have only one I make it a dandy."

OF MEDICINE IN GENERAL, dentist Stratton said, "Mother nature is a great healer but in the presence of fear and panic nothing works. My saying has always been, 'A belly laugh is better than a pill anytime.' When you are really down, the best cure is to do something good for somebody else."

Boyd C. Goldman, 100, of Indianapolis wrote that he had "never feared any part of living." Charles W. Stark advised "Avoid worrying." David Grilli, 100, of Stockton, Calif., suggested that a good formula might be "living with a sort of peaceful kindness within oneself."

Happy marriages and families also figured high on the list of reasons for a long life. Dan W. Quinbee, 100, of Denver, Colo., observed that sharing life with a loving and supportive wife, as well as great genes and an outdoor occupation involving lots of exercise, had kept him alive and healthy for a century.

"A good clean life, a happy marriage and six children," was the way Magrditch E. Dinhanian, 100, of Portland, Ore. put it.

An inquiring mind was another quality mentioned, but not as often as others. Rollin Wood, 101, of La Jolla, Calif., said that no one ever finished his education. Challenging, rewarding work was mentioned more often than mental inquisitiveness.

"Work for what you want," advised D. Howard Doane, 100, of Point Lookout, Md., obviously a practical man. "Save if it is only a nickel a week. Be tolerant — uncritical of others. Don't try to make others over, but stick to what you believe."

NORTHWESTERN MUTUAL HAS two women policy owners who have reached 100, but neither replied to the survey. One reason why there are so few women among the centenarians is that insurance companies stopped selling life insurance to women at the turn of the century because their life expectancy made them poor risks.

They began selling to women again when their life expectancy took an upward turn, but even today only 15 percent of all people covered by life insurance are women.

Senator PELL. Thank you very much indeed, Dr. Goldstein.

Some questions; I guess we will start out, if I may, with Dr. Katz. I am informed that the Federal Government is spending more than a quarter of its yearly budget—I think it is 27 percent—on people over 65, and the cost increases are much too large to be ignored. We must focus more attention, I guess, on future mortality rates.

What do you believe we should do about placing the emphasis for future Federal funding? If it is 27 percent now and it continues to go up with the number of older citizens, and most of these are programs that are a matter of right to the people involved, we could end up having 50 percent of our budget for those over a certain age.

Dr. KATZ. There are some implications in the principles that I previously set forth. I think that the efforts to maintain people at home should take priority over our concerns about institutionalization.

I believe that we have not tapped yet what savings in cost that effort would achieve. For example, I said that we should encourage self-reliance and the futhering of informal support by families and friends. Such supports would cost us less than some of the skilled services we put in place. There are times when skilled services foster dependency. Rehabilitation to achieve independence also requires education of the disabled, an intervention that is not adequately recognized in current approaches to services.

Senator PELL. But now one of the problems that I can recall in specific cases that we face is that if the person is institutionalized, there will be Federal financial support, whereas if they are not institutionalized and are treated at home, that support does not come.

Dr. KATZ. That is an example of one of the forces that is, in fact, hindering individuals from helping themselves. The people we heard this morning, Mrs. Tucker and Miss Clark, said they struggled and they tried, and they demonstrated the energy that they put into maintaining themselves. There was that kind of vitality in those people to be what they are.

Senator PELL. I think one of the great unsung groups that should be not only praised, but helped financially a great deal more than they are, is the visiting nurse service. They are now, as you know, somewhat beleaguered.

Dr. KATZ. Right. The merging or required coordination of visiting nurse activities with certain social services that are supported by the Administration on Aging would greatly increase the likelihood of effective assistance.

Senator PELL. Thank you. I would add on these different questions, if any of the panelists have a view they would like to advance, sing out.

Dr. Harvey, as I understand it, there are really two major causes of death, either disease-related or physical deterioration or aging. As I understand your view, you believe that disease-related matters are the cause of death, or would you think there is greater emphasis on physical deterioration?

Dr. HARVEY. Senator Pell, the leading causes of death in the United States now are heart disease, stroke, and cancer, with

trauma as a close fourth cause. In 1900, the causes were pneumonia and influenza, tuberculosis, and the diarrheal diseases.

If we can remove the causes of disease and thus these causes of death, then the individual has a genetically fixed length of life, a built in "biological clock," so to speak. As I said, like the one-horse shay, when the genetically fixed lifespan is over, the individual dies.

We have not as yet achieved that nirvana because we have not conquered heart disease, stroke, and cancer. But as Dr. Goldstein has said, the more we put into investigation, study, and scientific research in these areas, the better we will have created the quality of life for older individuals until the natural span of life is lived out.

I would like to add emphasis if I may, Senator, to one thing that Dr. Katz said I think it is very important to stress and I had mentioned it here in my testimony, we need to support the social support systems in the community. Dr. Katz and I have been talking about this need.

You are quite right. All of our Federal programs and most of our private health insurance programs do not support necessary social services in the community for geriatric patients. We have gone the institutionalization route for our geriatric care in contradistinction to other countries, particularly, the United Kingdom which has also emphasized community care programs.

I think one of the things we could do through our legislative process is to make more available funding for community health and social support systems for the elderly. This concept is written into the national health activities in England. They have not gone the institutionalization route, as I pointed out when I discussed the work of Dr. Marjory Warren and Sir Fergrerson-Anderson—they have kept geriatric patients in the community and provided excellent care and support to these patients in their own homes.

Senator PELL. And we have been able to reverse the institutionalization process when it comes to the mentally retarded. There is, as you know, a great move across the United States to deinstitutionalize the mentally retarded or deficient. Yet, we seem to be going in the opposite direction when it comes to those who are physically retarded.

Dr. HARVEY. That is absolutely correct. I think, you know, though, we have made a mistake in the deinstitutionalization of individuals who are mentally impaired or have intellectual impairment of such a severe degree that they cannot live alone on the outside. We see this mistake in the large numbers of the so-called street people.

Senator PELL. So we really ought to have the same approach to those who are mentally retarded and those who are physically retarded, and seek to deinstitutionalize them.

Dr. HARVEY. I prefer the term "incapacitated," not "retarded," but I think you are quite right, Senator.

Senator PELL. Now, if you could eliminate diseases which you mentioned, and eliminate them entirely, do you think the one-horse shay lifespan is the same for all groups?

Dr. HARVEY. Yes, I think it is. That was the point I was trying to make previously in my testimony. I do not think we are ever going

to expand the length of life for people. If we look at historical documents, and findings paleopathology, and the like there have been people in Egyptian times who lived to be 80 and 90 years of age but most people then only lived to 25 or 30 years of age. Thirty years of age was considered old in those times.

You know, Cicero wrote his great treatise on old age when he was, I think, 68 or 70 years of age. People have lived their natural span, if they were not carried off by disease, throughout recorded history.

Senator PELL. So the thought of achieving 150 or 200 is very unlikely, in your view?

Dr. HARVEY. I think that is wishful thinking and "pie-in-the-sky," and we ought not to talk that way. I think the anecdotal reports of these long-lived populations which I have mentioned in my testimony have given us that kind of hope. I think it is ridiculous.

Senator PELL. I must say it left a lasting impression on me to be with a dozen people who—in this case, it was in the city of Tbilisi, but they were from the outskirts, and I talked with the doctor in charge there and he said that those who made the extravagant claims of being 140, et cetera, he discounted.

But, apparently, from the baptismal records and other sources, those who said they were 110, can be confirmed. To sit around with this group of 10 or 15 people, all exceedingly vigorous and all over 100—some saying 105 and 107—it left a lasting impression on me, which is really why we are doing this hearing now.

Surely, those people have lengthened the life of the one-horse shay, would you not agree?

Dr. HARVEY. Yes, I agree with you there, and I think the thing that they teach is that eating right, having good health habits, working hard, exercising and being outdoors is what really helps human beings to continue to live out their full genetically-determined lifespan. In other words correct life styles are important to bring out one's fixed lifespan fully.

Certainly, we in the United States eat too much cholestrol. We have poor life styles in regards to health. We don't exercise as much as we should. We smoke. Our whole diet is quite different from these long-lived people in these remote villages which I reported to you, and we don't work physically as these people do.

Senator PELL. I was interested in the common denominator of the diets and the lifestyles of these people. I put the statement in the record earlier, but I noticed that they all exercised a great deal. They ate virtually no meat; one or two eggs a week, if that. They climbed up and down the mountains, which increased the blood pressure, apparently. They led full lives, full-family lives; had chores to do; were much respected and venerated; laughed a great deal; drank a good deal; smoked a pipe occasionally; and had, as Norman Cousins put it, enough laughter in their systems to ward off the effects of aging.

Dr. HARVEY. You have summarized it very beautifully.

Senator PELL. Thank you.

Dr. KATZ. If I may, one of the reasons that we have been more successful in acute diseases than the chronic diseases is that the acute disease have simpler causes.

The causes of chronic diseases are more complex. Heart disease, for example is influenced causally by genetics, by obesity, by smoking, by environment, as well as the mechanisms within the individual.

Many scientists speak of the chronic diseases as lifestyle diseases. Although there is plenty of reason for basic investigation we need research based on a broader ecologic view of mechanisms of disease which also examines effects of environment and lifestyle. This has not been facilitated within the National Institutes of Health programs.

Senator PELL. Thank you very much.

Dr. Goldstein, I would like to ask somewhat the same question I asked of Dr. Harvey to you. Do you believe that technological improvements or developments are making it possible to postpone death by eliminating certain diseases, but are not able to postpone or retard the actual aging process?

Dr. GOLDSTEIN. I wish I could give you a 100 percent answer on that, but I think there are a number of key questions still to be answered. The fact that if we eliminate all of the major causes of disease—cancer, heart attack, stroke, et cetera—it has been estimated that it will add only about 12 years to our life. That would be a marvelous scientific and medical achievement.

But if we do eliminate those major diseases, then we still have to address the more complex issues dealing with the aging process itself. It was generally assumed until a few years ago that that genetic clock was so built that it could not be modified.

Well, there have begun to appear in the literature suggestions that, in fact, it may be possible to modify, at least in animals, that clock somewhat. There have been some rather convincing arguments against the theory of Hayflick that the clock is such that at a certain point, down comes the anvil.

So I am not as sure as my colleagues that the time is absolutely fixed, but I would agree with them that the major goal we should be addressing is how to improve the quality of life.

I think it is possible to live to 100 and be vigorous and be healthy, as witnessed this morning by those two beautiful ladies, one almost 100, and one over 100. So, they are examples that it can be done.

Now, the question of what is it about those two ladies that enabled them to get to the point where they would have the strength to testify before your committee and do what they do—well, in listening to them, one obvious thing they indicated is that they had the good sense of choosing parents and grandparents that had a long life. That is the genetic element, and that came out loud and clear.

The second thing that came out is that both of them expressed enjoyment and pride in what they did and what they do, and they have a positive outlook on life. What we are finding with regard to the immune system, for example, is your outlook on life determines your general health.

It is known, for example, that students under stress and individuals, following the death of a mate, are much more susceptible to cancer, infectious diseases, and a number of other diseases. So the

way you think about life, per se, can influence your lifespan and can influence your health.

I think we have to learn more about the connection between the brain and the immune system in our overall health. We are learning a little bit about that now, from faith healing on one side to positive imagery—a new medical approach to the treatment of disease where one is trained to attack inwardly a disease process on the other side. We are beginning to understanding more about the basic biochemistry and immunology of our bodies.

Ongoing research is going to provide clues to achieve what I think your committee would like to achieve; that is, to improve the quality of life. I would like to make one last point, Senator, that has to do the high cost of health care and with your figure of 27 percent.

The problem we have right now is that the cost of health care is so high that it is really threatening our economy. And the reason that I stressed biomedical research and understanding more about the diseases of aging is that I think it is possible to reduce those costs significantly and at very minor cost if we can understand how to stay healthy.

If we understand the basic mechanisms, then older individuals would not have to have the chronic care that they have. I think it is possible to deal with the problems of aging in a positive way if we have a commitment to find the answers. Unfortunately, we are going in the opposite direction.

Senator PELL. Going to the genetic factor for a moment, I guess what you are really saying—and I wonder if a study has ever been done on this, that you take your four grandparents, add up the sum total of their ages, and divide by four, and that would give you a rough estimate of your lifespan.

Or more accurate would probably be your eight great grandparents, add that up and divide by eight, and that would be your lifespan. Has any experiment of that sort ever been done?

Dr. GOLDSTEIN. Well, I think there is a considerable amount of investigations that have gone on to try and fully understand the genetic influence with regard to longevity and incidence of disease. There is a major, major genetic component in almost every disease.

Senator PELL. Excuse me. That was not my question. My question was, Has an experiment of this sort been done to give people a probable estimate of their lifespan? In other words, you take your 8 great grandparents and your 16 great great grandparents, and if you could find out what their lifespan was, add up the sum total and divide, would you get a pretty accurate prediction?

Dr. GOLDSTEIN. No, I think probably not because each of your parents, grandparents, great grandparents, et cetera, had to live in their own environments and they did not have the antibiotics; they did not have the nutritional components. There were other factors that perhaps altered their ability to have a long and healthy life.

So I am not sure that would be the way that you could come up with an accurate figure, Senator.

Senator PELL. But as far as an experiment being done along this line, you are not aware of one?

Dr. GOLDSTEIN. None that I can quote off the top of my head.

Senator PELL. I was just curious. Incidentally, one of the points you mentioned about the importance of legislative efforts here—you will be pleased to know that the Older Americans Act passed both Houses and has been sent to the President with increased funding; maybe not as much as we would like, but it has been sent and it should be signed very shortly.

I can assure you we will heed your advice and your thoughts as to what we should be doing ourselves in a legislative way.

Also, to Dr. Goldstein, you mentioned the existence of a thymus-brain relationship that may help unravel the mystery of the causes of aging. What is the present status of this research?

Dr. GOLDSTEIN. Well, this is perhaps one of the most exciting new areas of biomedicine. In the last several years, we have found for sure that there is a strong interaction between the two.

This past December, Drs. David Healy and Dan Hodgens from the National Institutes of Health, and Dr. Nick Hall in my department of biochemistry, published an article showing that thymosin, when given to monkeys, could stimulate the production of two brain hormones—ACTH, which is involved in stress and resistance, and beta endorphin, which is a natural opiate of the brain which, in essence, is the hormone that is released during exercise and childbirth and sex, and is very important in terms of dealing with pain and with well-being.

This direct connection link, then, between the thymic hormones stimulating the brain is a link that now completes the circuit. We know that the brain can influence the immune system, and now we have established for the first time a feedback mechanism.

What I think it may mean to us in terms of aging is that one of the major problems that occurs with aging is the deterioration in our brain, but what occurs even earlier is a deterioration in our thymus, which begins to involute at puberty.

So it is very possible that some of the aging processes within the brain may be due to the earlier decline in our immune system, so that by stimulating and restoring the hormones of the immune system, we may be able to rejuvenate or strengthen our brain activities, and perhaps then help to do what apparently these two young ladies still have the ability to do.

I would love to be able to study their immune systems and, in fact, the immune systems of older individuals that have lived a long life. I would predict that in contrast to individuals who are ill, the immune systems in older people that are healthy will still be vigorous and normal.

Senator PELL. Very interesting. I thank you very much indeed. The record of this hearing will be kept open for 10 days for any additional views or questions to be submitted by members of the subcommittee and committee.

I again express my gratitude to our chairman, Senator Grassley, for permitting this hearing to take place, and to Mr. Conroy and both staffs, minority and majority, in working it out.

I thank you all very, very much indeed. It has been very helpful and educational, and I hope we may have more hearings along this line. As I said, we will reread and hopefully heed the advice of Dr. Goldstein.

We stand adjourned.

[Whereupon, at 12 p.m., the subcommittee was adjourned.]

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